Volume 60

# American Machinist

Number 7

New York, February 14, 1924

# Civic Reciprocity

*Among his friends and to the members of the National Founders' Association, of which he is president, William H. Barr is well known for his interest in good government. For years he has hammered away in an effort to break down the apathy with which the average business man considers political matters. Now that possible legislative action in Washington on taxation and transportation questions, to name but two of the problems vital to business men, is attracting unusual attention, Mr. Barr's remarks on the relations between the citizen and his representative are particularly timely.*

**By William H. Barr**

President, National Founders Association

MANY of the stupidities of our government are really due to the misconception by the people themselves of what government is. It does not seem to be definitely fixed in the mind of the ordinary citizen that his government is made up of representatives selected by himself and other citizens, and that it is functioning in accordance with what is presumed to be the will of the people. Neither does it seem to be clearly understood that the laws which are passed should represent the direct will of a majority of the people themselves. For the most part both law-makers and executive officials seem to be in the hazy distance insofar as many good and intelligent citizens are concerned. There should be nothing hazy about the responsibility of our representatives and our executive officials. There should be nothing indefinite in the mind of any man as to their position. They are clearly the servants of the people, sent to Washington to carry out the will of our citizens and if they fail to do so they are responsible to the electorate. Many a business man who would direct the manager of one of his departments to come to his office and explain certain things concerning his administration hesitates to approach his Congressman.

If our people can fix in their minds the idea that their representatives and the heads of the great departments in Washington are not super-men vested with extraordinary power, or men who hold themselves aloof from public contact, but rather that these men are anxious to serve and serve well, we shall have a different national situation. The citizen has two political duties. One is to select and elect representatives, both state and federal, and the other is to keep these representatives informed concerning his ideas on matters of public importance. There exists today almost complete indifference in the selection of public officials, very little attention is paid to their election and an entire abandonment of co-operation is evident as soon as they come into office.

On the other hand, the citizen having recognized the position of his representative, and realizing that the government is there for service and not merely for repression, should not look to the government on every occasion when he thinks he wants something. Men rail against paternalism or the interference of government in their affairs and yet they clutter the mail with demands for this, that and the other favor. Many a Congressman is burdened with letters from citizens who never heard of Primary Day, who utilize Election Day for golf or the theater, who never co-operate in the administration of the affairs of the government, but who feel that they are entitled to receive favors at any time from every government official.

If every citizen will adopt the policy of reciprocity, we shall have more efficient government because we shall have better executives and law-makers. The President of the United States likes to receive suggestions, comment and advice. So does your Congressman and your Senator. It does not take long to write a letter explaining impersonally conditions in your immediate neighborhood or in your particular industry, giving ideas as to things that might be done for the general

benefit. For each letter of comment, advice and help which a Congressman receives there are four others asking for favors or demanding some particular action be taken which is personally beneficial. The letters which come for the purpose of advising some broad policy, helpful to an industry, to a community or to a state, are few and far between.

### Even the Wisest Representative Is Not a Mind Reader

Your government is yourself. It is your own creation or it ought to be. Its members are responsive and responsible. They are not mind readers. They are not super-men. They are good average American citizens and they cannot properly represent you unless you vocalize your wishes, your opinions and your ideas. Neither can they intelligently represent your state or your congressional district if you or your acquaintances persistently fail to recognize that your representatives are there for all the people of the district or state and not to promote individual interests. In other words, try to realize the fact that when a law is created which is beneficial to an entire community or state you are a greater beneficiary than when you seek to secure individual preferment.

We talk of radical Senators and Congressmen. Are they actually radical, or do they believe that they are representing a sentiment in their state which is best served by the attitude which we call radical? These men might be conservative in the extreme if they knew their constituency was conservative. The Tory, the Liberal, the Progressive, the Radical, are merely names given to the sentiment which the representative in Congress is supposed to represent. Therefore, the policy of a representative is determined by his knowledge and understanding of the wishes of his constituency. The radical citizen in a constituency is both vocal and voluble. The conservative is silent and often suspicious; consequently the Congressman or Senator basing his activities on the knowledge which comes to him often adopts a radical attitude because he feels that he is representing his district properly, through the information which comes to him only from an active minority. Educate your representative concerning conditions. Take a patriotic view of your district, community or state and when you ask for something do so, by all means, as a citizen of a state and in an impersonal capacity.

### Intelligent Co-operation Will Help to Prevent Governmental Stupidity

There must be reciprocity in government and understanding between chosen representatives and those who select them. There must be a community of interest and intelligent co-operation. Until this is more generally true there will be stupidities in government which are not so much the fault of representatives as of those who are directly concerned with the failure to keep government officials advised. If any public servant were omniscient there would be no need for helpful suggestions. If he were omniscient, however, he would probably not be holding public office. Assume then that your representative has more than average intelligence and knowledge. Broaden this average knowledge and supplement any limitations which he may have by your own earnest co-operation and there will be more understanding in government and less interference with business.

# Casting Crown Brasses and Hub Plates in Place—Discussion

By F. M. A'Hearn

The article on page 729, Vol. 59 of the *American Machinist* under the title given above, relative to casting crown brasses and hub plates on locomotive driving boxes is valuable, and further information on the subject would be appreciated by railway mechanical men.

Arranging the information given in the article referred to in the form of a table, as shown, we find several essential points not mentioned.

It will be seen that conclusions cannot be arrived at unless more definite information is available. For this reason the writer suggests a questionnaire to embody, at least, the following points:

1. Type of locomotive.
2. Driving box hub-face material or driving box hub-plate material.
3. Driving wheel hub-face material or driving wheel hub-plate material.
4. Average crown brass mileage between renewals.
5. Average hub-plate mileage between renewals.
6. Composition or kind of babbitt metal, when that metal is used.
7. Method of driving box lubrication.
8. Method of lubricating hub face.
9. Are the mileages given actual or estimated?
10. Why are brass hub plates preferable to babbitt or vice versa?
11. What tonnage per inch of journal diameter is used in pressing brasses into driving boxes?

The maintenance of locomotive driving boxes is a most important part of the work of the railway mechanical department and affords an opportunity for the editor to go even further in an effort to arrive at the best practice, not only in the methods used in the shop operations which are of secondary importance, but in developing information that will bring about a greater mileage between shoppings for driving box and hub plate renewals, keeping in mind that the cost for repairs per mile run is the index of the best method of maintenance.

**Summary of Data Regarding Crown Brasses, Wear and Hub Plates**

| Shop Number | Crown Brass & Hub Plate Cast in One Piece | Crown Brass Fitted and Brass Hub Plate Cast on Box | Crown Brass Fitted and Babbitt Hub Plate | Crown Brass Fitted. Brass Wear Plate on Wheel | Type of Loco. | Mileage Crown Brass | Mileage Brass Hub Plate | Mileage Babbitt Hub Plate | Wheel Hub Face |
|---|---|---|---|---|---|---|---|---|---|
| 1 | X | | | | 4-6-0 | 115,000 | 115,000 | | |
| 2 | | X | | | 2-8-2 | | | | Gray Iron |
| 3 | | X | | | | 150,000 to 200,000 | 75,000 to 100,000 | | |
| 4 | | | X | | Freight Passenger | 25,000 to 50,000 90,000 | | 25,000 to 50,000 90,000 | |
| 5 | | X | | | | 160,000 | 80,000 | | |
| 6 | | | X | | | | | | |
| 7 | X | | | | | | | | O. H. Steel Brass |
| 8 | | | | X | | | | | |
| 9 | | | X | | | | | 60,000 to 70,000 | |
| 10 | | X | | | | 180,000 | 60,000 | | |
| 11 | | X | | | | | | | |
| Total | 2 | 5 | 3 | 1 | | | | | |

# Data on Aluminum Alloys for Airplane Structural Work

**By Fred H. Colvin**
Editor, *American Machinist*

Standardizing channels, struts and other parts for the construction of all-metal planes, even in small quantities —Sizes and strength of rivets—Distribution of weight

WHILE the airplane industry is hardly at the point where much standardization can be accomplished it is interesting to note the work along this line of Paul G. Zimmerman, chief airplane engineer of the Aeromarine Plane & Motor Corp., Keyport, N. J. In designing the all metal fuselage used in the mail plane and the flying-boat body, it was decided to use as few shapes as possible and so reduce the cost of manufacture, even though these shapes had to be made by hand, which is always a slow and tedious process.

Through the courtesy of Mr. Zimmerman some of the shapes used are illustrated herewith and their dimensions given. The material, a product of the Aluminum Co. of America, is what is known as 17-S Alloy, an aluminum-copper alloy which can be compared to duralumin. The data given in the accompanying illustrations may prove of value in other lines of work.

The sheets vary from $\frac{1}{16}$ in. to 0.040 in. in thickness and are held by three sizes of rivets, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in., as shown in the tables. Struts and stringers vary in thickness of metal used but shapes have been standardized to a remarkable extent as can be seen from the accompanying tables and diagrams. The data on rivet practice is of special value, as this is a new field and one in which

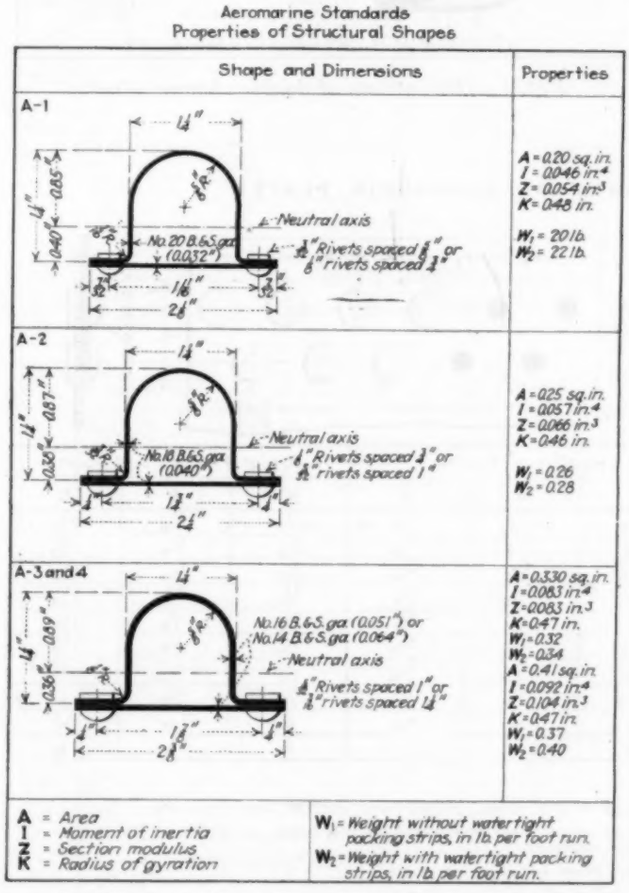

Aeromarine Standards
Properties of Structural Shapes
Shape and Dimensions
Properties
A-1
A = 0.20 sq.in.
I = 0.046 in.⁴
Z = 0.054 in.³
K = 0.48 in.
W₁ = 20 lb.
W₂ = 22 lb.
Neutral axis
No. 20 B.&S. ga. (0.032")
A-2
A = 0.25 sq.in.
I = 0.057 in.⁴
Z = 0.066 in.³
K = 0.46 in.
W₁ = 0.26
W₂ = 0.28
Neutral axis
No. 18 B.&S. ga. (0.040")
A-3 and 4
A = 0.330 sq.in.
I = 0.083 in.⁴
Z = 0.083 in.³
K = 0.47 in.
W₁ = 0.32
W₂ = 0.34
A = 0.41 sq.in.
I = 0.092 in.⁴
Z = 0.104 in.³
K = 0.47 in.
W₁ = 0.37
W₂ = 0.40
No. 16 B.&S. ga. (0.051") or No. 14 B.&S. ga. (0.064")
Neutral axis
A = Area
I = Moment of inertia
Z = Section modulus
K = Radius of gyration
W₁ = Weight without watertight packing strips, in lb. per foot run.
W₂ = Weight with watertight packing strips, in lb. per foot run.

*Fig. 1—Dimensions of shallow channels*

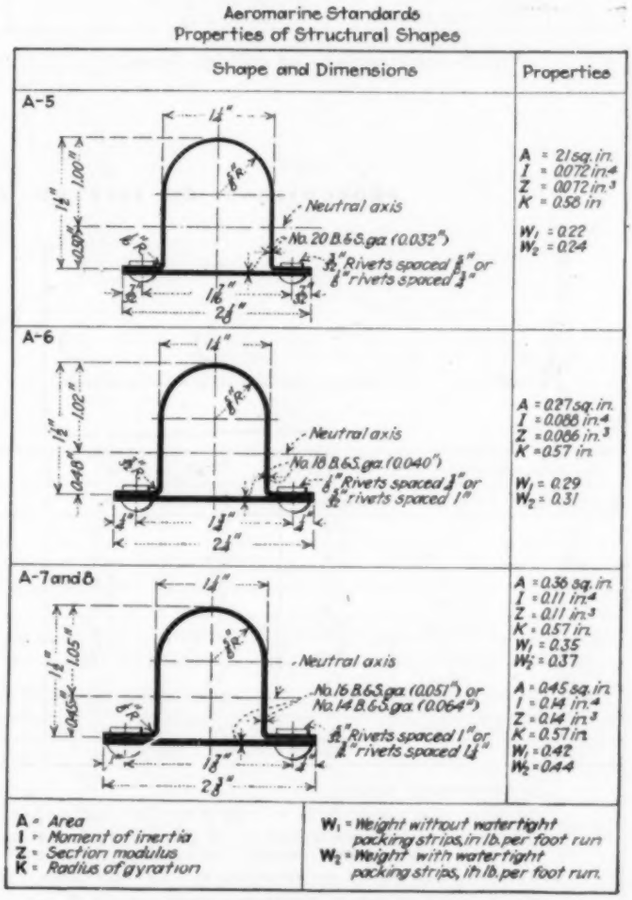

Aeromarine Standards
Properties of Structural Shapes
Shape and Dimensions
Properties
A-5
A = 21 sq.in.
I = 0.072 in.⁴
Z = 0.072 in.³
K = 0.58 in.
W₁ = 0.22
W₂ = 0.24
Neutral axis
No. 20 B.&S. ga. (0.032")
A-6
A = 0.27 sq.in.
I = 0.086 in.⁴
Z = 0.066 in.³
K = 0.57 in.
W₁ = 0.29
W₂ = 0.31
Neutral axis
No. 18 B.&S. ga. (0.040")
A-7 and 8
A = 0.36 sq.in.
I = 0.11 in.⁴
Z = 0.11 in.³
K = 0.57 in.
W₁ = 0.35
W₂ = 0.37
A = 0.45 sq.in.
I = 0.14 in.⁴
Z = 0.14 in.³
K = 0.57 in.
W₁ = 0.42
W₂ = 0.44
Neutral axis
No. 16 B.&S. ga. (0.051") or No. 14 B.&S. ga. (0.064")
A = Area
I = Moment of inertia
Z = Section modulus
K = Radius of gyration
W₁ = Weight without watertight packing strips, in lb. per foot run
W₂ = Weight with watertight packing strips, in lb. per foot run.

*Fig. 2—Dimensions of deeper channels*

Aeromarine Standards
Properties of Structural Shapes

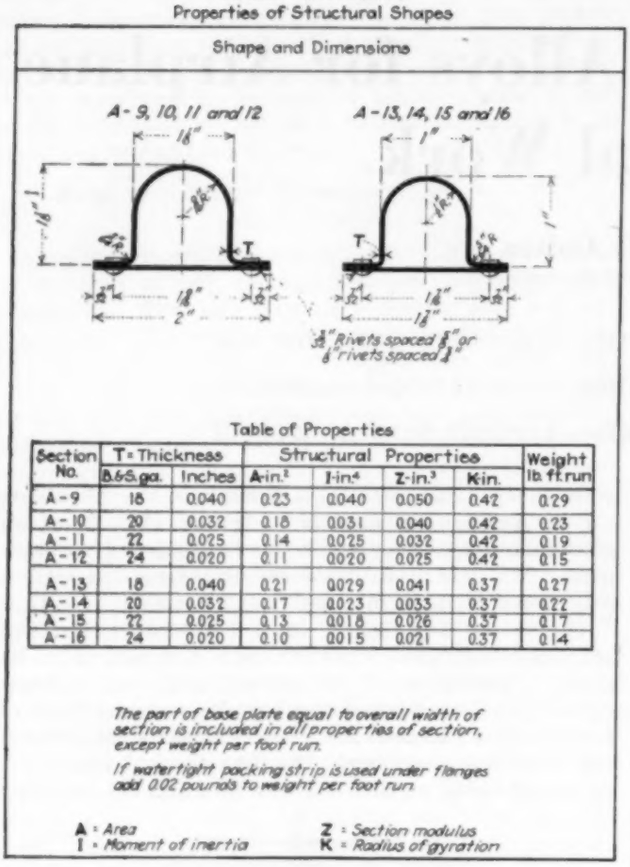



Table of Properties

| Section No. | T = Thickness | | Structural Properties | | | | Weight lb. ft. run |
|---|---|---|---|---|---|---|---|
| | B.&S. ga. | Inches | A-in.² | I-in.⁴ | Z-in.³ | K-in. | |
| A-9 | 18 | 0.040 | 0.23 | 0.0040 | 0.050 | 0.42 | 0.29 |
| A-10 | 20 | 0.032 | 0.18 | 0.0031 | 0.040 | 0.42 | 0.23 |
| A-11 | 22 | 0.025 | 0.14 | 0.0025 | 0.032 | 0.42 | 0.19 |
| A-12 | 24 | 0.020 | 0.11 | 0.0020 | 0.025 | 0.42 | 0.15 |
| A-13 | 18 | 0.040 | 0.21 | 0.0029 | 0.041 | 0.37 | 0.27 |
| A-14 | 20 | 0.032 | 0.17 | 0.0023 | 0.033 | 0.37 | 0.22 |
| A-15 | 22 | 0.025 | 0.13 | 0.0018 | 0.026 | 0.37 | 0.17 |
| A-16 | 24 | 0.020 | 0.10 | 0.0015 | 0.021 | 0.37 | 0.14 |

*The part of base plate equal to overall width of section is included in all properties of section, except weight per foot run.*

*If watertight packing strip is used under flanges add 0.02 pounds to weight per foot run.*

A = Area
I = Moment of inertia
Z = Section modulus
K = Radius of gyration

*Fig. 3—Dimensions of special channel*

Aeromarine Standards
Properties of Structural Shapes

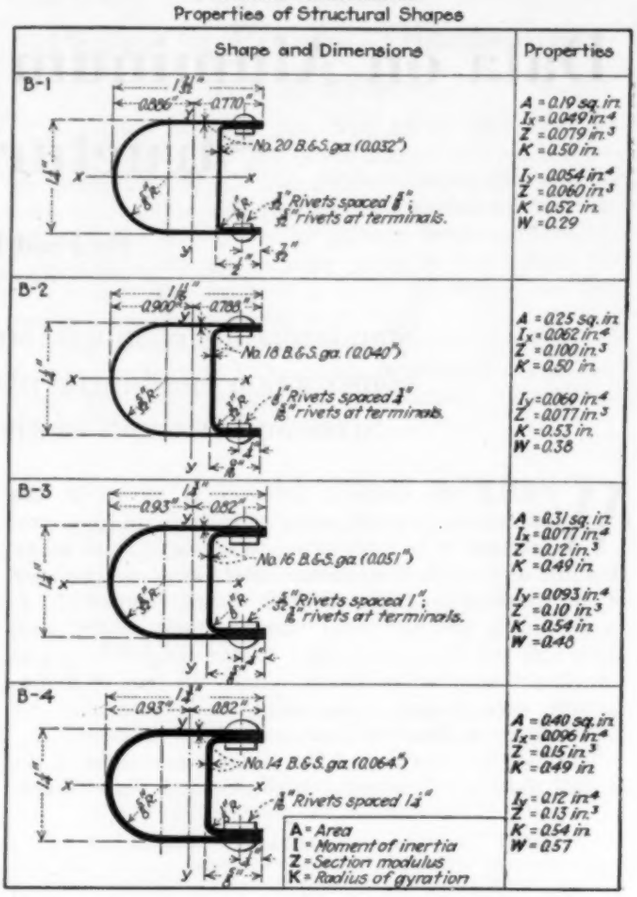
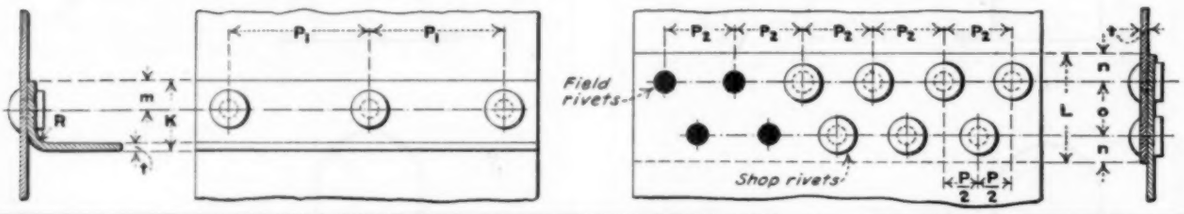



*Fig. 4—Dimensions of double channel struts*

## PROPORTIONS OF RIVETED JOINTS OF DURALUMIN PLATES




| Thickness of Plate-t | | Rivet D | Rivet Spacing | | Location of Rivets | | | Sizes of Flanges and Joints | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B & S Gage | Inches | Inches | $P_1$ | $P_2$ | m | n | o | K | R | L |
| 6 | 0.162 | 3/8 | 3 | 1 3/8 | 7/16 | 1/2 | 1 1/8 | 1 3/8 | 5/16 | 2 1/8 |
| 8 | 0.128 | 5/16 | 2 1/4 | 1 1/8 | 3/8 | 7/16 | 7/8 | 1 1/8 | 1/4 | 1 3/4 |
| 10 | 0.102 | 1/4 | 1 3/4 | 7/8 | 5/16 | 3/8 | 3/4 | 7/8 | 3/16 | 1 1/2 |
| 12 | 0.081 | 3/16 | 1 1/2 | 3/4 | 1/4 | 5/16 | 5/8 | 3/4 | 5/32 | 1 1/4 |
| 14 | 0.064 | 5/16 | 1 1/4 | 3/4 | 1/4 | 5/16 | 5/8 | 5/8 | 1/8 | 1 1/4 |
| 16 | 0.051 | 5/32 | 1 | 5/8 | 1/4 | 5/16 | 5/8 | 9/16 | 1/8 | 1 1/4 |
| 18 | 0.040 | 1/8 | 3/4 | 1/2 | 7/32 | 9/32 | 9/16 | 1/2 | 3/32 | 1 1/8 |
| 20 | 0.032 | 3/32 | 5/8 | 3/8 | 5/16 | 1/4 | 1/2 | 7/16 | 1/8 | 1 |
| 22 | 0.025 | " | " | " | " | " | " | " | " | " |
| 24 | 0.020 | " | " | " | " | " | " | " | " | " |

*Supplementary Notes.*

*(a) When two plates to be riveted differ in gage by one place in the table, proportion joint to lighter plate.*

*(b) When two or more plates to be riveted differ in gage by more than one place in the table, proportion joint to mean gage, taking nearest lighter gage in case of odd number.*

*(c) Rivet spacing to be governed by rivet diameter, rather than by gage of plate.*

*(d) In joints of minor importance rivet spacing $P_1$ may be doubled.*

*Fig. 6—Rivet spacing for plate work*

**TABLE OF SHEAR AND BEARING VALUES FOR DURALUMIN RIVETS**

| Diameter of Rivets | Shear Pounds | Bearing Values for Various Thicknesses – Pounds for Sheets in Brown and Sharp Gage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No 6 0 162 | No.8 0 128 | No.10 0 102 | No.12 0 081 | No.14 0 064 | No.16 0.051 | No.18 0.040 | No.20 0.032 | No.22 0.025 | No.24 0 020 |
| 3/32 | 241.5 | 1,062 | 840 | 670 | 532 | 420 | 335 | 262 5 | 210 | 164 | 131.2 |
| 1/8 | 420 | 1,420 | 1,120 | 894 | 710 | 560 | 447 | 350 | 280 | 219 | |
| 5/32 | 672 | 1,720 | 1,400 | 1,115 | 885 | 700 | 558 | 437.5 | 350 | | |
| 3/16 | 966 | 2,125 | 1,680 | 1,340 | 1,062 | 840 | 670 | 525 | | | |
| 1/4 | 1,720 | 2,840 | 2,240 | 1,785 | 1,418 | 1,120 | 892 | | | | |
| 5/16 | 2,695 | 3,545 | 2,800 | 2,230 | 1,770 | 1,400 | | | | | |
| 3/8 | 3,860 | 4,260 | 3,360 | 2,680 | 2,125 | | | | | | |

Based on Shear Strength – 35,000 lb. per Sq. In.
Bearing Strength – 70,000 lb. per Sq. In.

*Fig. 7—Strength of duralumin rivets*

very little information is available. The various diagrams and tables show the care that has been given to the design of these metal planes. And it is well to note the contrast with plane construction of only a few years ago. The changes have indeed been many and progress has been remarkable.

It will be noted that the channel with a ⅛-in. inside radius is the basis of all but two of the channels, but that the depth of the channel varies to suit conditions.

**PROPERTIES OF STRUCTURAL SHAPES**

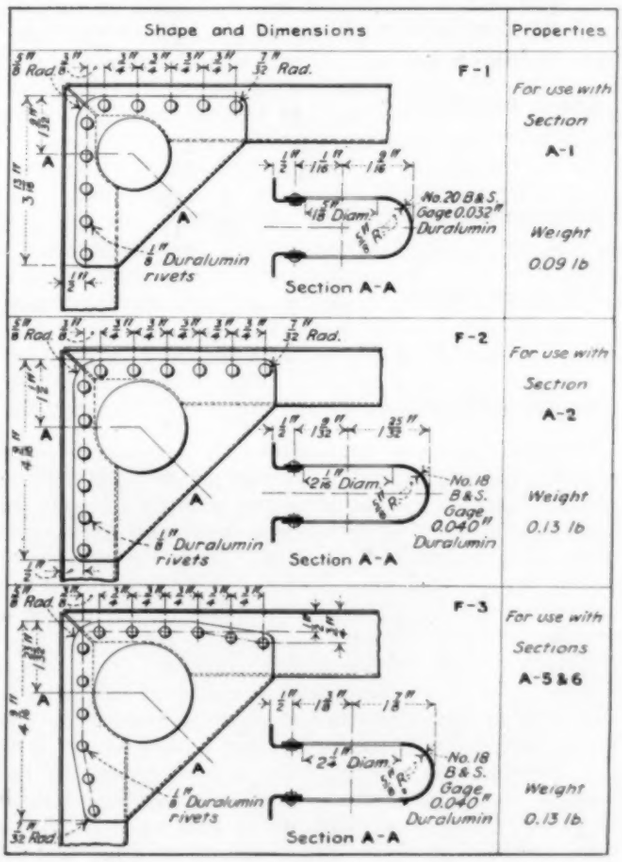
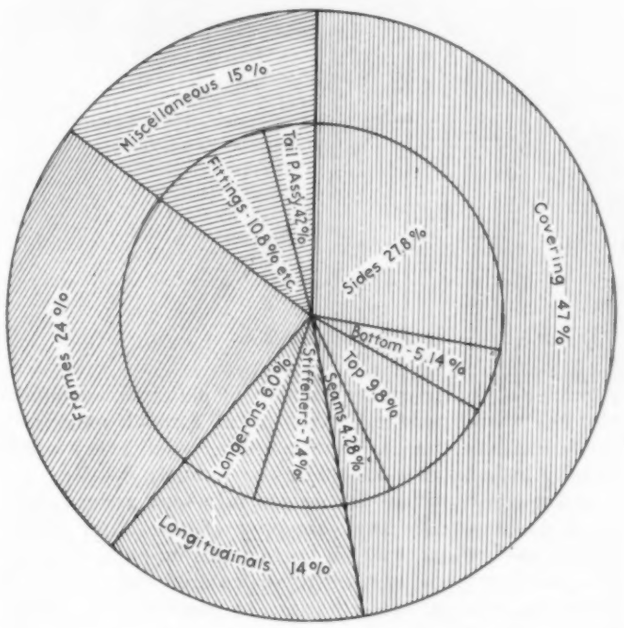



*Fig. 5—Dimensions of corner braces*




| | | |
|---|---|---|
| Coverings | 127 Lb. | 47% |
| Frames | 64 Lb. | 24% |
| Longitudinals | 38 Lb. | 14% |
| Miscellaneous | 29 Lb. | 15% |
| Total Weight, | 268% | 100% |

*Calculated from drawing number 17,813*

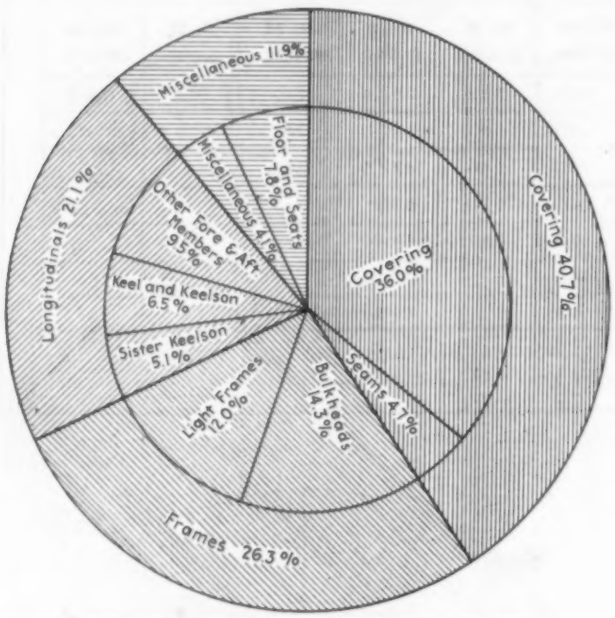
*Fig. 8—Weight distribution of mail plane*

In most cases the edges of the channels are flanged to prevent a flat base, as in the illustrations, Figs. 1, 2 and 3. For some work, however, the sides of the channels are straight and the bases are formed by other flat-bottomed channels which fit inside the first, as in Fig. 4. In Fig. 5 the corner braces are shown in both elevation and section.

The proportions of the riveted joints of duralumin plates are given in Fig. 6. This table gives the proper rivet for the thickness of plate used, the spacing of the

rivets and the sizes of the flanges and joints. In Fig. 7 the properties of the rivets themselves are shown.

The weight distribution diagrams, Figs. 8 and 9, are also of interest as showing that airplane designing is approaching an established manufacturing basis. The




| | | |
|---|---|---|
| Covering | 327 Lb. | 40.7% |
| Frames | 212 Lb. | 26.3% |
| Longitudinals | 170 Lb. | 21.1% |
| Miscellaneous | 96 Lb. | 11.9% |
| Total Weight | 805 Lb. | 100% |

*Miscellaneous weight includes all seats, floors, fittings, etc integral with hull*

*Fig. 9—Weight distribution of flying boat*

purchase of a fairly large number of planes for commercial use would permit production at a much more economical figure than is now possible, when every order usually includes new specifications in many details.

These charts divide the weight into four general divisions as shown by the segments of the outer circle. Inside are the items which go to make up each division. The weights are very carefully calculated and the charts show the weight distribution in considerable detail. One is for the mail plane and the other for the flying boat.

## Cost Systems for Reducing Factory Expenses

BY WILLIAM R. BASSET

Study of cost figures has made it possible for one medium-sized concern to save more than $50,000 a year by improving its manufacturing methods. That a cost system can be made to point out possible betterments is just beginning to be realized by some manufacturers. As a matter of fact, if costs are used solely as a guide in setting selling prices, their greatest value is being wasted.

Merely to look at a workman or a machine is a mighty uncertain fashion in which to determine whether the work is being done in the best possible way. A properly designed cost system will, however, give definite information as to whether the efficiency of any operation is what it should be.

## Calculations for Differential Indexing

BY GEORGE C. SMITH

The calculation of differential indexing gear trains is considered by many a subject beyond their mental capacities but, as a matter of fact, the method described on pages 180 and 181 of the *American Machinist's Handbook*, is comparatively simple. There is no reason why the average milling machine hand should not be able to solve the problem.

Before considering the method mentioned above, let us solve for the change gears required to cut a gear with 81 teeth, using the regular method of calculation. Under the assumption that one or both of the change gears may not be on hand, as computed in the first calculation, we will also make several trials.

It is evident that 81 teeth cannot be cut by the method of simple indexing, because a crank movement of $\frac{40}{81}$ is required and the index plate has no 81 hole circle. Using the 82, 84, 85 and 80 hole index circles, the following change gear ratios are found:

(1)—82 hole circle,

$$\text{Crank movement} = \frac{40}{82} = \frac{20}{41}$$

$$\frac{20}{41} \times 81 = \frac{1620}{41} = 39\,\frac{21}{41}$$

$$\text{Change gear ratio} = 40 - 39\,\frac{21}{41} = \frac{20}{41}$$

(2)—84 hole circle,

$$\text{Crank movement} = \frac{40}{84} = \frac{10}{21}$$

$$\frac{10}{21} \times 81 = \frac{810}{21} = 38\,\frac{12}{21}$$

$$\text{Change gear ratio} = 40 - 38\,\frac{12}{21} = \frac{30}{21}$$

(3)—85 hole circle,

$$\text{Crank movement} = \frac{40}{85} = \frac{8}{17}$$

$$\frac{8}{17} \times 81 = \frac{648}{17} = 38\,\frac{2}{17}$$

$$\text{Change gear ratio} = 40 - 38\,\frac{2}{17} = \frac{32}{17}$$

(4)—80 hole circle,

$$\text{Crank movement} = \frac{40}{80} = \frac{1}{2}$$

$$\frac{1}{2} \times 81 = \frac{81}{2} = 40\,\frac{1}{2}$$

$$\text{Change gear ratio} = 40 - 40\,\frac{1}{2} = -\frac{1}{2}$$

Considering these calculations, it becomes evident that in the first trial the number of the index circle (82) is greater by one than the number of teeth to be cut, and that the crank movement and gear ratio are equal. In trial 2 the number selected is greater by three, the resulting gear ratio being three times the crank movement. Trial 3 shows that by the use of a number which is greater by four, a gear ratio four times the crank movement is required.

The above observations lead to the short cut method, and it is evident that the calculations made after the crank movement is determined are unnecessary. It is only necessary to multiply the crank movement by the number of the index circle minus the number of teeth to be cut. The minus sign of the gear ratio in trial 4 simply means that two idlers are to be used instead of one.

# Great Northern Railway Shop Kinks

**By Howard Campbell**
Western Editor, *American Machinist*

## Cutting reverse lever quadrant teeth—Slotting out links and making dies on a key-seating machine—An excellent flue-cutter — Safety valve tester — Driving box gages

THE VALUE of a machine lies in the use that is made of it, not in the purchase price. The truth of this statement is evidenced by the use made of a key-seating machine in the Great Northern railway shops, St. Paul, Minn. One of the interesting operations performed on the machine is that of cutting teeth on reverse lever quadrants. The quadrants are usually made of forged steel, although cold drawn steel is also used for this purpose. The machine is a Morton key-seating machine with a 24x26-in. table and an 18-in. stroke. Six pieces are machined at a setting, being clamped to the table as shown in Fig. 1. The cutter, which is of ¾x1-in. high-speed steel, is ground to produce the correct shape for a ¾-pitch tooth and is attached to the cutter-bar in the same manner as the standard keyway cutter. Any desired pitch of tooth can be obtained by grinding the cutter to give it the proper form.

The six quadrants are bolted together at both ends, the bolts thus used also serving to attach to the quadrants a pair of arms that are pivoted to an extension which is attached to the machine table. The arms hold the quadrants so that the correct radius is obtained as the teeth are cut. The correct distance between tooth centers is maintained by the use of the pin *A*, which is a sliding fit in a hole in the plate that is bolted to the machine table. The plate is located so that the center of the pin and the center of the cutter are the correct tooth distance apart, then after the first groove has been cut, the quadrants are moved over until the pin slips into place in the groove. This method of locating is repeated until all the teeth have been cut. Six pieces are finished in from four to eight hours, depending on the pitch and number of teeth to be cut.

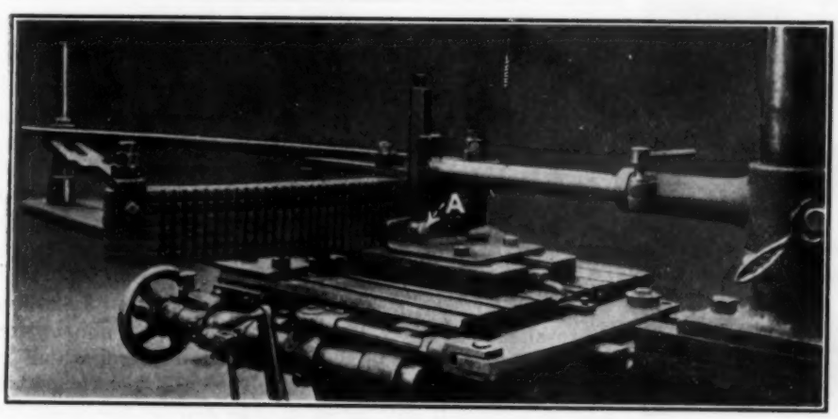



*Fig. 1—Cutting teeth in reverse lever quadrant*

The same tool that is used for cutting the teeth in the reverse lever quadrants is also used for cutting the teeth in the reverse lever quadrant latches. The latches are steel forgings and are bolted, two together, in a vertical position to an angle plate which is in turn

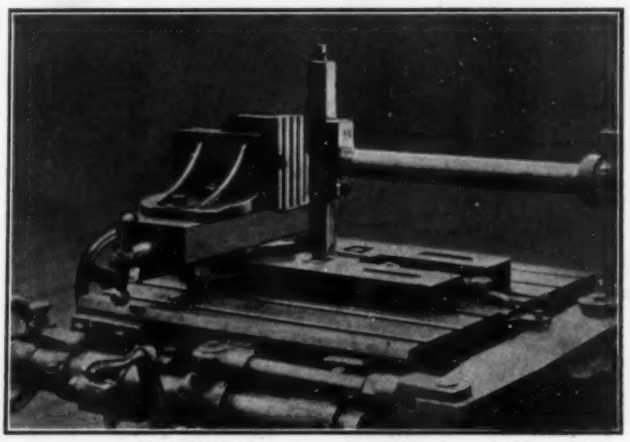


*Fig. 2—Cutting teeth in reverse lever quadrant latch*

bolted to the top of a slide rest that is attached to the machine table as shown in Fig. 2. In this case the tooth center distance is obtained by graduations on the side of the slide and the use of a formed gage. Two pieces can be set up and machined complete in one hour on this machine. There are other uses that widen the field of application of this piece of equipment.

The illustration, Fig. 3, shows how the same machine is adapted for slotting out links. The fixture consists of two large flat plates *A* and *B*, one resting on top of the other. The lower plate *B* is bolted to the machine table, which is clamped in a fixed position, while the upper plate is pivoted to the lower plate at the point *C*, and attached to the feeding mechanism, which can be seen in Fig. 4. Here it can be seen that the top plate is attached to the nut *A*, through which is threaded the feed-screw *B*, which is part of the attachment. The feed-screw is attached to the lower plate by means of bearings at either end, as shown. The feed handwheel, ratchet and ratchet-wheel have been removed from the machine feed-screw and attached to the feed-screw *B*, while

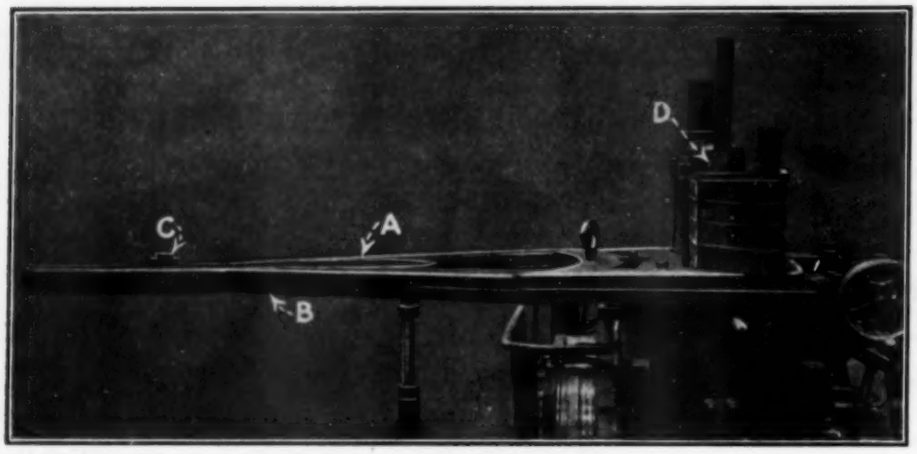



*Fig. 3—Slotting out links*

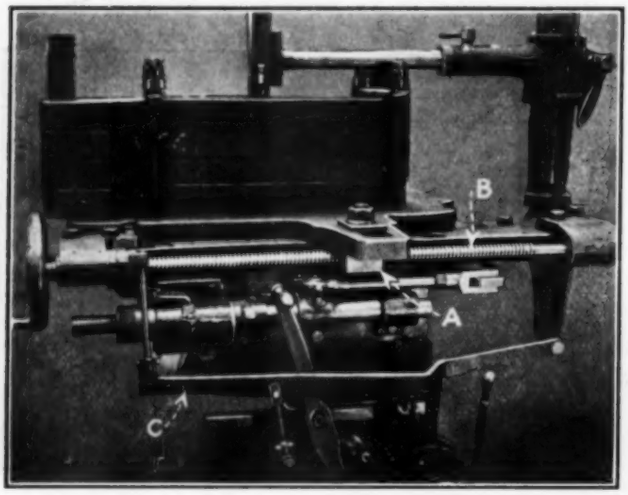



*Fig. 4—Side view of machine*

the connection rod from the feed regulator to the ratchet has been replaced by the arm *C*, which is connected to both the ratched and the feed regulator. The arm *C* is a part of the fixture and is hinged to a piece that is bolted to the lower plate. When the machine is in operation, the feed-screw *B* is operated by the feed regulator in the usual manner, and the upper plate is fed across the machine, swinging at the desired radius. Two tools are used, one projecting from each side of the bar as shown at *D*, Fig. 3, so that both sides of the link opening can be machined without resetting the tool. Any number of links up to the capacity of the machine, which is 18 in., can be machined at a setting. One link can be slotted in approximately 1½ hr., and the time is reduced proportionately when several are machined at the same time.

The illustration, Fig. 5, shows the machine described in the preceding paragraph set up for the operation of slotting out bolt-header die blocks. The piece is held to the fixture by ordinary clamps, and the tool is special according to the shape of hole that is to be produced. A tool for shaping a hexagon hole is indicated at *A*. The round plate *B*, which is held by the clamps shown, is graduated on the edge so that the proper divisions for producing either a square or hexagon hole can be obtained. Approximately 15 min. is required for setting up the job, while the cutting time is from 30 to 40 min. for a square hole similar to the one shown, which is 1⅜ in. The pieces are drilled to the size of the square or hex desired, then the holes are slotted out to the desired shape on this machine. The hole is then closed at one end by driving a piece of stock of similar shape and size into the opening.

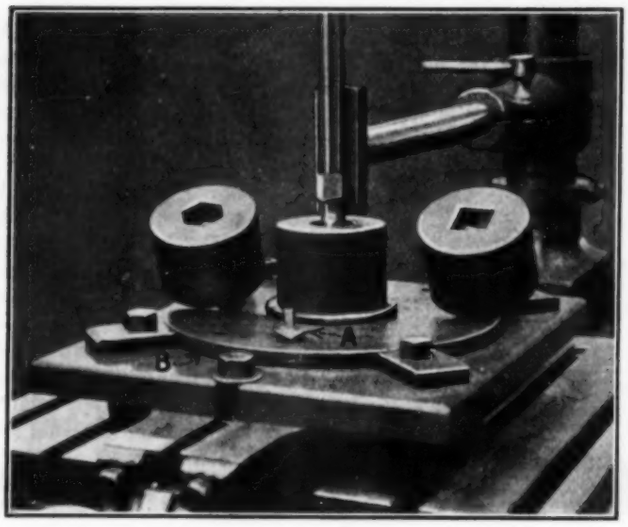



*Fig. 5—Slotting holes in die blocks*

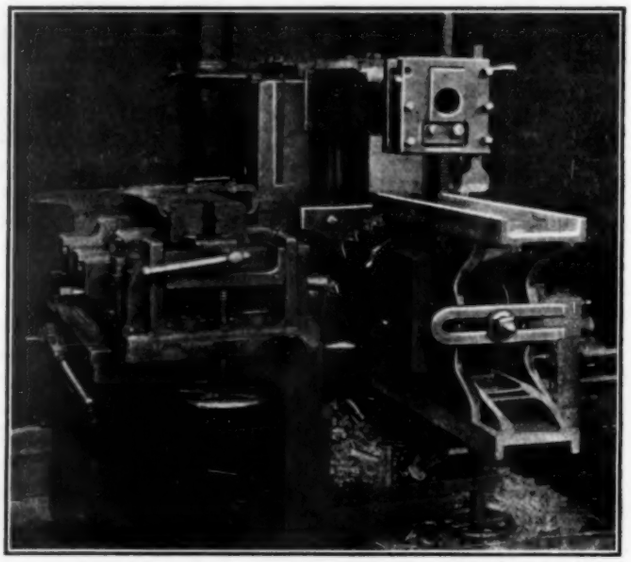


*Fig. 6—Planing crossheads*

The illustration Fig. 6 shows the operation of planing a crosshead, using a Morton 32-in. railway shaper for the job. The piece is slipped onto a mandrel which is part of a fixture that slides onto the rail of the machine and is arranged so that it can be fed by the machine feeding mechanism. A jack under the bottom of the

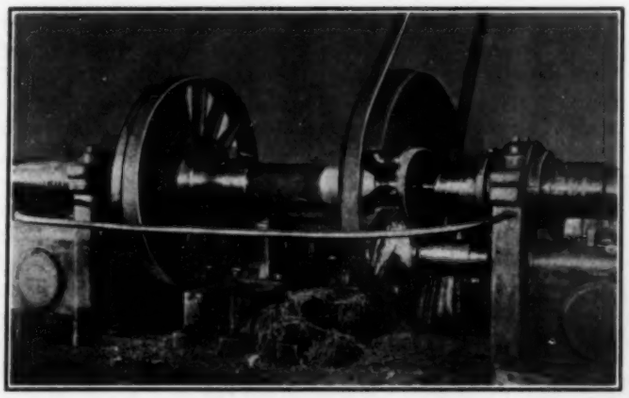


*Fig. 7—Machining axle journals*

crosshead provides adjustment for parallelism. Mandrels are made for the fixture to fit all classes of crossheads. The tool is a section of 1x2-in. Rex AA high-speed steel, spread at the end to take a cut 3 in. wide. The machine takes a 32-in. stroke at the rate of seven strokes per minute, with a feed of from $\frac{3}{32}$ in. to $\frac{1}{16}$ in., which is possible when cutting babbitt. With $\frac{1}{4}$ in. to

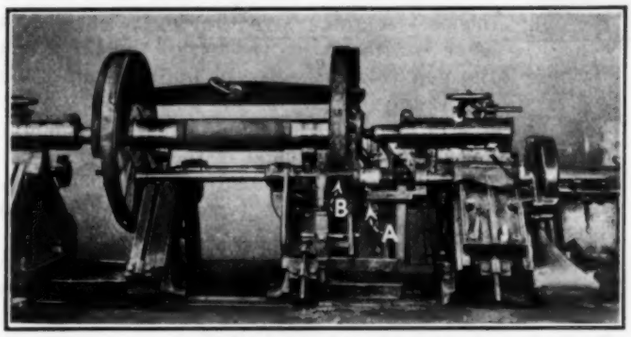



*Fig. 8—Turning crankpins*

$\frac{1}{2}$ in. of stock to come out, an operator can plane both sides of the crosshead in approximately 40 minutes without difficulty.

A shoe and wedge planing attachment with a leveling device and which will take either a shoe or a wedge can be attached to the Morton railway shaper. The level gage is used instead of the usual surface gage, and a shoe or wedge can be planed in from 7 to 10 min., regardless of thickness.

An old Putnam wheel lathe that has been reclaimed as a journal lathe is shown in Fig. 7, turning a driving wheel axle. Pieces of lead are bolted to the wheel at a point which will offset the weight of the rod counterbalance, and the work is driven by a belt direct from the countershaft to one of the wheels, a speed of 25 r.p.m. being thus obtained. Both journals are turned simultaneously, the two tool rests being located on a slide that is operated by one hand-wheel. Both hand and power feed are used. The tools are of 1x1$\frac{3}{4}$-in. Rex AA high-speed steel. The average amount of stock to come off is $\frac{3}{32}$ in., which is removed in one cut and the journal is then rolled. Oil is used to facilitate the rolling operation. The average time required to turn a pair of axle journals is 1$\frac{1}{2}$ hours.

A Niles-Bement-Pond quartering machine in operation turning a pair of crankpins is illustrated in

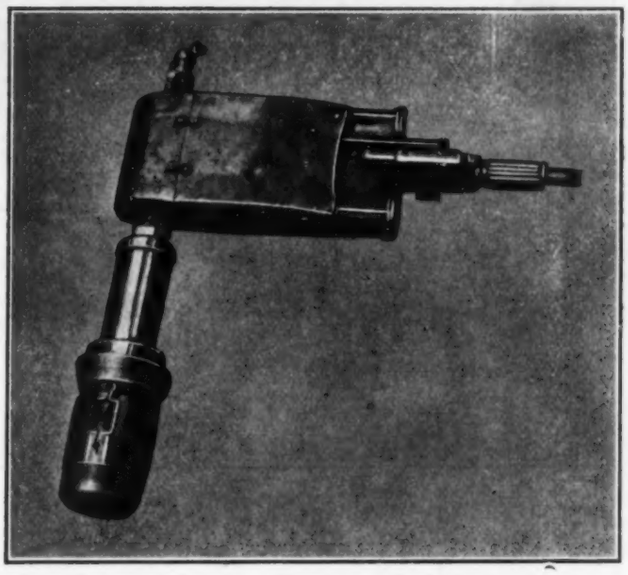
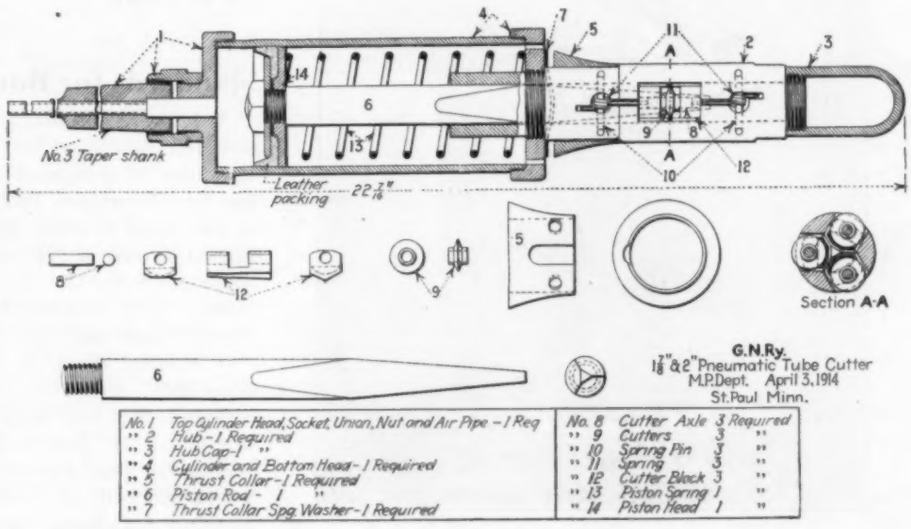


*Fig. 9—A rotary flue cutter*

Fig. 8. The tools are of $\frac{7}{16}$ in. x 1 in. Rex AA high-speed steel, formed to clear the end of the tool-holder, as shown at *A*. The wheels are held in position by clamps at either side, in addition to the clamp indicated at *B*, which is adjustable so that the crankpins can be quartered accurately. As the amount of stock to be removed is just enough to clean up, one cut is usually all that is necessary. The tools revolve about the pins at a speed of 14 r.p.m., with a $\frac{1}{32}$-in. feed. The pins on a pair of driving wheels can be turned complete, floor to floor, in approximately one hour.

The illustration, Fig. 9, shows the Fuhrmann flue-cutter, which is used in the Great Northern shops,




| | | | |
|---|---|---|---|
| No. 1 | Top Cylinder Head, Socket, Union, Nut and Air Pipe – 1 Req | No. 8 | Cutter Axle 3 Required |
| " 2 | Hub – 1 Required | " 9 | Cutters 3 " |
| " 3 | Hub Cap – 1 " | " 10 | Spring Pin 3 " |
| " 4 | Cylinder and Bottom Head – 1 Required | " 11 | Spring 3 " |
| " 5 | Thrust Collar – 1 Required | " 12 | Cutter Block 3 " |
| " 6 | Piston Rod – 1 " | " 13 | Piston Spring 1 " |
| " 7 | Thrust Collar Spg. Washer – 1 Required | " 14 | Piston Head 1 " |

*Fig. 10—Details of flue cutter*

attached to a Chicago Pneumatic "corner" motor. The cutting is done by three high-speed steel disks which are expanded by a wedge that is forced between them by the action of the air. The tool consists principally of a cylinder with a No. 3 taper shank attached to one

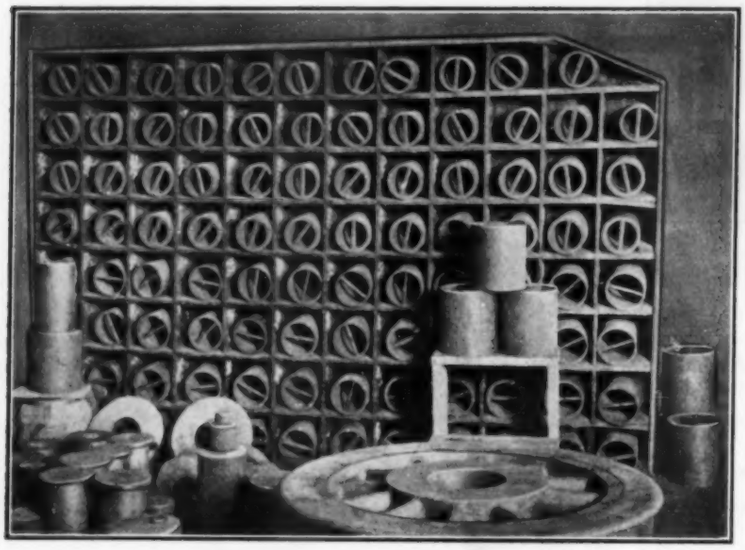


*Fig. 12—Driving box mandrels*

head and the part which carries the disc operating mechanism attached to the other, as shown in Fig. 10. A hole lengthwise through the shank admits air to the cylinder. The wedge is of round stock with a thread on one end which screws into a piston head and the other end is made triangular so that as it is forced forward by the action of the air, the wedge spreading the parts which carry the cutters. The construction of the cutter mechanism is indicated at Section A-A. A heavy spring in the cylinder forces the piston head back and withdraws the wedge from between the cutters when the air is shut off. As the wedge recedes, the small springs shown in the front end of the tool contract the cutting mechanism. The same design of tool is used for cutting superheater flues, except that the wedge and front end parts are made to larger dimensions. A man can cut off a 2-in. flue in six seconds, or a 5½-in. flue in 15 seconds, and 350 flues have been cut out of a boiler in two hours with this tool. One set of cutters will cut from 1,000 to 3,000 flues.

A device for testing safety or "pop" valves is illustrated in Fig. 11. The tank is 36x42 in., and is made of ¾-in. boiler plate, put together with 1½-in. staybolts. The tank is calculated to withstand a pressure of 1,000 lb. per square inch. Air is forced into the tank by means of a booster pump made of a 9½-in. Westinghouse air pump, bushed down to four inches. A gate valve that operates with a lever is attached to the top of the tank, and the pop valve is screwed onto a connection in the top opening of the gate valve. When the gate valve is opened, a gage indicates the amount of pressure per square inch, and if the valve does not pop at the desired pressure, it is adjusted until it does. One man can test and adjust twenty-four valves in eight hours with this outfit.

The boring and fitting of driving box journals on the floor has been eliminated in the Great Northern shops by the use of the mandrels shown in Fig. 12. The mandrels are of cast iron, of the same length as the brasses, and are stepped up in sizes from the smallest to the largest used, by sixty-fourths of an inch. The brasses are bored and fitted to the mandrels, and as the journals are also machined to even sixty-fourths of an inch in diameter, when the boxes leave the department, they are ready for use. Each mandrel is cast with a handle across the top, and each one is kept in a separate bin with the size marked on the bin as shown.

*Fig. 11—Safety valve tester*

## Standards for Round Unslotted Bolt Heads

A table of standard dimensions for "carriage" bolts is being published by the S.A.E. and the A.S.M.E., in the form of a reprint sheet from *Mechanical Engineering* for December, 1923.

The table is from the report of a sub-committee submitted to the above societies, and consists of standard dimensions for the six well-known, round, unslotted bolt heads. They are called: (1) Common carriage bolt, (2) Button-head carriage bolt, (3) Fin-neck carriage bolt, (4) Ribbed carriage bolt, (5) Elevator bolt, and (6) Step bolt.

The report has been approved by the Sectional Committee of the sponsor societies and is now before these bodies for final approval and adoption. After such approval it will be transmitted to the American Engineering Standards Committee for approval as a "Tentative American Standard."

# How Dynamite Was Used in Breaking a Large Wheel

By H. B. Barnes
Consulting Engineer, Denver, Colo.

WHILE dynamite is not generally recognized as one of the tools of the trade, yet there are many places where its use will produce substantial saving of time, effort, and expense. Such a case was the removal of a large pulley from a location so inaccessible as to involve practically the wrecking of the building to get it out in one piece, with a saving in time and expense obtainable in no other way.

The whole art in using explosives in industry is to break or to move what you want to, and nothing else. Hence it is necessary that the most careful judgment be used to apply enough force to do the work without shattering or the scattering of small pieces, as these small pieces will move at terrific velocity and can do great damage. No "mud-capping" or other cover is necessary or desirable, and while the explosive may not be used with maximum efficiency, it can be used with perfect safety.

Usually any proposal to use dynamite indoors brings a horrified protest from the property owner if from no one else, as the idea of high explosives has so long been associated with that of widespread and general destruction that the dissociation of the two ideas is difficult if not actually impossible. To say that one has exploded thirty sticks of 40 per cent gelatin powder inside a small frame building without completely wrecking it, and with a total damage of one 8x10-in. pane of glass, might reasonably require an explanation, so it is submitted herewith.

The job consisted of the removal of a large solid cast-iron multiple-grooved rope sheave 8 ft. in diameter and weighing approximately 2,500 lb. from a water-wheel shaft in an electric lighting plant. The pulley was rusted tight on the 6-in. shaft and was in a location where the lifting out of the shaft would have involved a heavy expense, and what was more important, the shutting down of the plant for several days.

### Why Dynamite Was Needed

A board partition was located within 21 in. of the pulley center on one side, a similar partition was only 48 in. from the opposite side, the back wall was only 28 in. from the pulley and the roof was about 5 ft. above it. The periphery of the pulley had been lagged up with wood for use with an 18-in. belt. After the wood was removed a strenuous effort was made to break up the pulley with heavy sledges in the hands of two men; but the material of the pulley proved to be an unusually coarse-grained, tough metal, and it soon became evident that breaking by that method was an almost hopeless proposition. At this point the writer got busy with dynamite.

The sequence of operations was as follows: Holes ¾ in. in diameter were drilled clear through the spokes close to the hub, and a row of ¾-in. holes was drilled along each side of the hub. Also, one hole nearly 6 in. deep was drilled in the center on one side of the hub, the entire drilling job requiring the time of two men for about six hours.

With the wheel in a position so that a certain spoke was vertical, a whole stick of ¼x8-in. du Pont 40 per cent gelatin was exploded in the groove at the top center of the wheel, directly over the spoke, with the result that the rim was split sideways and cracked loose from the end of the spoke. This operation was repeated around the wheel, using whole and half sticks as pieces were loosened, until the entire rim was broken into pieces which one man could handle easily. Care was used to break pieces from opposite sides in sequence so that the mechanical balance of the wheel was maintained to a degree that permitted turning it without too great effort.

With the rim removed, the holes in the spokes were then filled completely full of powder, a cartridge being broken for the purpose and the loose powder rammed into the holes with a small stick. No wadding or capping of any kind was used and the fused cap was inserted directly into a small hole punched into the powder, only one hole at a time being loaded. This astonishingly small quantity of explosive was found ample to crack the spoke so that a light tap with a sledge served to break it off completely.

### How the Hub Was Removed

After removing the last of the spokes, which weighed nearly 100 lb. each, two of the four holes on each side of the hub were similarly rammed full of loose powder and fired, the explosion of the last shots cracking the hub but not throwing any small pieces whatever. The one deep hole in the center of the hub was then loaded, requiring only about one-third of a stick of powder. The explosion split the hub cleanly through the center and dropped it in two pieces on the floor almost directly under the shaft, leaving the shaft clean and absolutely unmarred or even scratched.

This last shot was responsible for the only direct damage done. Some small pieces of iron were broken from near the top of the hole and propelled parallel to the shaft, through the board partitions on either side of the wheel. Even this damage could have been avoided by loading the hole in the hub only half full of powder and, if necessary, shooting it a second time, although the results indicated that half the amount of explosive used would probably have done the work. Too much care cannot be used to guard against overloading where small pieces are liable to be broken off, and it is far better practice to take the chance of underloading and shooting the same hole a second or a third time.

A total of about thirty sticks, or 8½ lb., of du Pont 40 per cent gelatin was used. Approximately 50 caps and 40 ft. of fuse were required, making a total cost of material for the job less than $4. The writer personally handled the whole job, spitting the fuse with matches and then retiring for a distance of 30 or 40 ft. just out of a direct line. Owing to the fact that no capping was used the shots were, of course, very noisy, and as a matter of personal comfort the ears were stopped while waiting for the shots to go off. One window located about 5 ft. from the wheel was taken out of its frame while doing the job, but all the others were left in place and propped open. The one piece of glass broken was in a sash some 20 ft. away which was jarred shut by concussion, the shock of dropping cracking one piece of glass.

In using explosives indoors under circumstances such as these it is important to have all windows open, both to relieve the concussion air pressure and to secure all

Abstracted from "Dynamite—the Machinist's Friend" in the *Du Pont Magazine*.

possible ventilation for quick removal or dilution of the smoke and gases from the shots. If one is in too great haste to fire the next shot and inhales too much smoke and gas, a "powder headache" may result. While this headache involves only a few hours of discomfort, yet even this trouble may be avoided by waiting possibly two or three minutes after each shot before returning to the scene of action.

The writer has applied explosives on several jobs of this sort, and is an ardent advocate of their use. A stick or two of powder mud-capped on the end of a shaft will do more than any amount of sledging, and many a job can be finished before a hydraulic jack or other pressure device can even be set up. The absolute safety of modern explosives places within the reach of any one a simple source of tremendous power, and if a reasonable amount of common sense is used there need be no hesitation in taking advantage of it.

# Locomotive Defects Increase 50 to 70 Per Cent

A STUDY of the 12th Annual Report of the Chief Inspector, Bureau of Locomotive Inspection of the Interstate Commerce Commission for the year ending June 30, 1923, reveals many interesting facts. Tables have been arranged to show the comparison between the years from 1919 to 1923, and the data covers all defects in the locomotive and tender, including the boiler.

The striking feature of these tables is the great increase in accidents in 1923 over any previous year. Roughly speaking there were about twice as many accidents of nearly every kind, with approximately twice as many killed or injured as in 1922 or previous years, although the number of locomotives inspected was slightly less in 1923.

Among the noticeable defects which have increased in number are such parts as tubes, ash-pan blowers, blow-off cocks, brakes and brake rigging, crossheads and guides, draft gear, flues, grate shakers, injectors, reverse gears, main and side rods, springs and spring rigging, superheater tubes, trucks, valve gears and water glasses. The number killed as a result of these accidents was 72 in 1923 as against 33 in 1922, while the injured numbered 1,560 in 1923 and 709 in 1922. Accidents due to axles, couplers, crank pins and wheels remained about the same as before. As pointed out by the inspector "The number of locomotive miles per locomotive failure decreased as much as 50 to 70 per cent during the year and that every locomotive failure caused by physical defects carries with it potential injury to persons, serious delay to traffic, and heavy property damage."

There is also a very interesting chart showing defects in locomotives, number of accidents and casualties beginning with 1912. Beginning with 65.7 per cent of locomotives with defects of some kind in 1912 the percentage dropped 44.4 in January 1915. The number of accidents dropped from 856 to 424 and casualties from 1,096 to 480 in the same period. This period covered only locomotive boilers and their appurtenances.

Beginning in February, 1915, the inspection covered all parts of both locomotives and tenders, including boilers, and the number of defects naturally increased, but not nearly so much as might have been expected.

### Accidents Increase After Shop Strike

The rise is very gradual, being probably partially due to an increase in thoroughness of inspection. From July, 1915, to January, 1917, there was a gradual rise, a slight drop in defects during 1917, a rise of 4 per cent in 1918 and then a gradual decrease until in January, 1922, the percentage was 48. During 1922, however, the defects increased to 65 per cent, the number of accidents to 1,348, and the casualties to 1,632, a much greater increase than was apparently warranted by the number of defects.

There seems to be but one reason for this increase in locomotive defects, accidents and casualties. It seems to be the direct aftermath of the shopmen's strike and points out the desirability of avoiding such conflicts in future, where it is humanly possible to do so. For the direct toll in lives alone totals up to 890 more than the previous year.

The chief inspector deals with the subject of autogenous weldings with an open mind. He says, "The autogenous welding process is practically in its infancy, and due to my desire to avoid hindering the progress or development of any process of such great value, when properly and discreetly used, I have hesitated to ask this commission to establish or approve rules or regulations restricting its use. However, unless it is confined by the carriers to parts and appliances where, through failure, accidents and injuries will not result, we will be compelled to adopt some more restrictive measures in the very near future."

### Autogenous Welding Still in Infancy

This conclusion is the result of the investigation of numerous accidents in which the failure of autogenous welded joints was involved. These he contends, fully support the previous position of the commission that this process has not reached the state of development where it can safely be depended upon in boiler construction and repair, where the strain to which the structure is subjected is not carried by other construction which conforms to the requirements of the law and the rules and regulations issued in pursuance thereof, nor in firebox crown-sheet seams where overheating and failure are liable to occur, or on any part of the locomotive or tender subject to shock or strain where, through failure, accident and injury might result."

The report points out that with 70,000 locomotives coming under jurisdiction of the commission, housed at 4,600 different places, and used on 265,000 miles of main line track, that it is impossible for 50 inspectors to cover the work properly. It also states that many officials who are responsible for the locomotives being in proper repair, evade this responsibility and allow them to remain in service until detected by I. C. C. inspectors and ordered to the shop for repairs. Part of this seeming neglect may, of course, be due to an honest difference of opinion as to the necessity of given repairs.

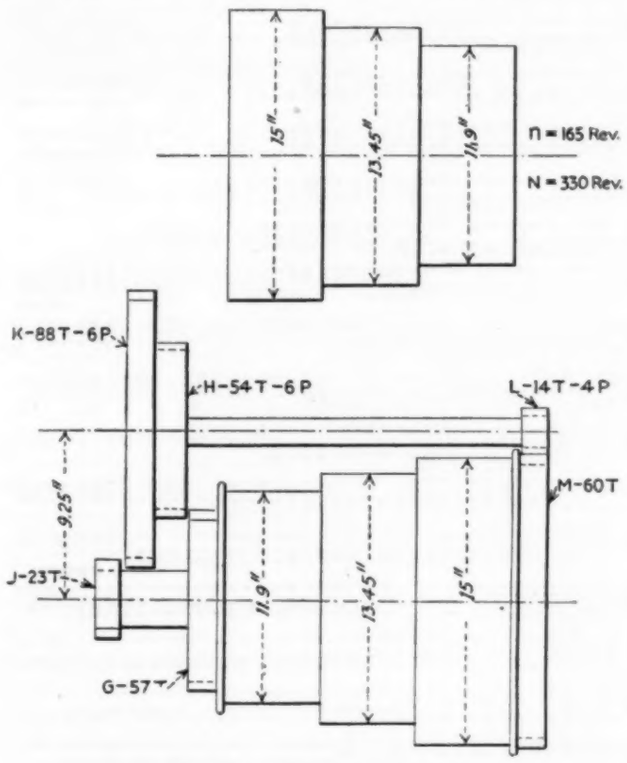
Regardless of one's personal opinion on the subject, all who are interested in modern railroading can find much of interest in this report. And when it is considered that nearly every repair to the defects noted involves the use of machine tools, the need of more and better equipment in railway shops is strongly emphasized.

# The Design of Cone Pulley Drives

By Sam Odegaard

## Complete design method—Useful tables for quick computation—Design of back gearing—Belt width and horsepower —The design of a drive for a 24-in. lathe as an example

SEVERAL articles on this subject have from time to time appeared in the technical journals and several years ago, when the writer was interested in the reconstruction and modernizing of machine tools, he looked through some of these articles and investigated the matter with the object of finding the best and quickest way of solving such problems. The results of this investigation are given in the following article. In considering the matter, it seemed that the formulas




*Complete cone pulley drive*

for cone pulley drives could be arranged in such a way that, by means of a slide rule and a table, as Table II, the different quantities could be quickly found.

When starting the design of a cone pulley drive, some of the factors will, of course, be given, while others must be assumed. Usually the swing is given, and the cutting speed at that diameter either given or assumed. This fixes the slowest spindle speed.

The next things to decide on are the ratio between speeds, the number of speeds and the highest speed. It is important that there should be a proper geometrical ratio between the speeds. This has been pointed out by F. W. Taylor, Carl G. Barth and others and the reasons need not be repeated here. Generally this ratio will be between 1.2 and 1.3, although on some lathes it is as high as 1.5 or even more.

The following symbols may be used:

$S$ = Slow spindle speed
$F$ = Fast spindle speed
$u$ = Number of spindle speeds
$R$ = Ratio between spindle speeds
$D$ = Largest diameter of cone
$d$ = Smallest diameter of cone
$c$ = Number of steps on the cone
$B_1$ = First back gear ratio
$B_2$ = Second back gear ratio
$B_3$ = Third back gear ratio
$n$ = Slow counterspeed
$N$ = Fast counterspeed

Then

$$R = \sqrt[u-1]{\frac{F}{S}} \qquad \text{(I)}$$

$$\frac{F}{S} = R^{u-1} \qquad \text{(II)}$$

This well-known formula gives the relation between the ratio, the lowest and highest spindle speeds and the number of speeds, and Table I shows at a glance the number of spindle speeds resulting from the different combinations of the various factors.

It can further be shown that:

$$\frac{D}{d} = R^{\frac{c-1}{2}} \qquad \text{(III)}$$

$$B_1 = R^{2c} \qquad \text{(IV)}$$

$$B_2 = R^{4c} \qquad \text{(V)}$$

$$B_3 = R^{6c} \qquad \text{(VI)}$$

$$\frac{N}{n} = R^c \qquad \text{(VII)}$$

$$N = F\,\frac{d}{D} \qquad \text{(VIII)}$$

$$R = \sqrt[\frac{c-1}{2}]{\frac{D}{d}} \qquad \text{(IX)}$$

To show the application of the formulas, let it be required to design a cone pulley drive for a 24-in. lathe, the cutting speed at the 24-in. diameter to be about 50 ft. per min. In order to get a reasonable ratio between the speeds, a lathe of this size should have 16 to 18 speeds. Looking at Table I, we find that a four-step cone with one back gear and a two-speed counter gives 16 speeds, and a three-step cone with two back gears and a two-speed counter gives 18 speeds. We will use the last arrangement and the slow spindle speed will then be $\frac{50}{2\pi}$, say 8 r.p.m. Fig. 1 shows the complete drive arrangement.

It will be observed that in the formulas III to VII the different quantities, cone diameters, back gear ratios and counterspeed ratios are expressed in terms of the ratio $R$, raised to a certain power, depending on the number of cone steps. When the ratio $R$ and the number of cone steps are settled, the values of $R^n$ may be found directly from Table II.

## Table I—Number of Spindle Speeds Corresponding to a Given Number of Cone Steps, Back Gears and Counter Speeds

| No. of Counterspeeds | No. of Back-Gears | Number of Spindle Speeds: 2 step cone — Open Belt | Back Gear | Total | 3 step cone — Open Belt | Back Gear | Total | 4 step cone — Open Belt | Back Gear | Total | 5 step cone — Open Belt | Back Gear | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | 4 | 3 | 3 | 6 | 4 | 4 | 8 | 5 | 5 | 10 |
| 1 | 2 | 2 | 4 | 6 | 3 | 6 | 9 | 4 | 8 | 12 | 5 | 10 | 15 |
| 2 | 1 | 4 | 4 | 8 | 6 | 6 | 12 | 8 | 8 | 16 | 10 | 10 | 20 |
| 2 | 2 | 4 | 8 | 12 | 6 | 12 | 18 | 8 | 16 | 24 | 10 | 20 | 30 |
| 2 | 3 | 4 | 12 | 16 | 6 | 18 | 24 | 8 | 24 | 32 | 10 | 30 | 40 |

Trying a ratio $R = 1.26$, we find that $R^{n-1} = 1.26^{17}$, and the value of this we find directly from Table II to be 50.9. Inserting this value in equation II,

$$F = 8 \times 50.9 = 408 \text{ r.p.m., approximately.}$$

Using equations III, IV, V and VII and Table II, the following values are then found:

$$\frac{D}{d} = 1.26^{\frac{3-1}{2}} = 1.26$$

$$B_1 = 1.26^{2c} = 1.26^{8} = 4$$

$$B_2 = 1.26^{4c} = 1.26^{16} = 16$$

$$\frac{N}{n} = 1.26^{3} = 2$$

Assuming that $D$ is 15 in. we get

$$d = \frac{D}{1.26} = 11.9 \text{ in., and from equation VIII}$$

$$N = \frac{408 \times 11.9}{15} = 324 \text{ r.p.m.}$$

$$n = \frac{324}{2} = 162 \text{ r.p.m.}$$

We found that $B_1 = 4$, and from Fig. 1 it is evident that this value equals $\frac{H}{G} \times \frac{M}{L}$. Likewise $B_2 = 16 = \frac{K}{J} \times \frac{M}{L}$.

Using steel gears we may try 6 pitch for gears $G$, $H$, $J$ and $K$, and 4 pitch for gears $L$ and $M$. Making $L = 14$ teeth and $M = 60$, the center distance is found by the formula:

$$a = \frac{t+T}{2P} = \frac{14+60}{2 \times 4} = 9.25 \text{ in.}$$

The sum of teeth in gears $J$ and $K$ will then be

$$J + K = 2aP = 2 \times 9.25 \times 6 = 111 \text{ teeth}$$

We have $\frac{M}{L} = \frac{60}{14} = 4.28$, and consequently $\frac{K}{J} = \frac{16}{4.28} = 3.74$.

Then $J = \frac{111}{3.74+1} = 23.4$, say 23 teeth.

$$K = 111 - 23 = 88 \text{ teeth.}$$

As we found $B_1 = 4$, $\frac{H}{G} = \frac{4}{4.28} = 0.935$.

$$G = \frac{111}{0.935+1} = 57.5, \text{ say 57 teeth.}$$

$$H = 111 - 57 = 54 \text{ teeth.}$$

The actual gear ratios will then be as follows:

$$B_1 = \frac{60}{14} \times \frac{54}{57} = 4.06$$

$$B_2 = \frac{60}{14} \times \frac{88}{23} = 16.4.$$

## Table II—Calculated values of $R^n$

| R | $R^2$ | $R^3$ | $R^4$ | $R^5$ | $R^6$ | $R^7$ | $R^8$ | $R^9$ | $R^{10}$ | $R^{11}$ | $R^{12}$ | $R^{13}$ | $R^{14}$ | $R^{15}$ | $R^{16}$ | $R^{17}$ | $R^{18}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.15 | 1.32 | 1.52 | 1.75 | 2.01 | 2.31 | 2.66 | 3.06 | 3.52 | 4.05 | 4.65 | 5.35 | 6.15 | 7.08 | 8.14 | 9.36 | 10.8 | 12.4 |
| 1.16 | 1.35 | 1.56 | 1.81 | 2.10 | 2.44 | 2.83 | 3.28 | 3.80 | 4.41 | 5.12 | 5.94 | 6.89 | 7.99 | 9.27 | 10.8 | 12.5 | 14.5 |
| 1.17 | 1.37 | 1.60 | 1.87 | 2.19 | 2.56 | 3.00 | 3.51 | 4.11 | 4.81 | 5.63 | 6.58 | 7.70 | 9.01 | 10.5 | 12.3 | 14.4 | 16.9 |
| 1.18 | 1.39 | 1.64 | 1.94 | 2.29 | 2.70 | 3.18 | 3.76 | 4.43 | 5.23 | 6.17 | 7.28 | 8.59 | 10.2 | 12.0 | 14.1 | 16.7 | 19.7 |
| 1.19 | 1.42 | 1.68 | 2.01 | 2.39 | 2.84 | 3.38 | 4.02 | 4.79 | 5.70 | 6.78 | 8.07 | 9.60 | 11.4 | 13.6 | 16.2 | 19.3 | 23.0 |
| 1.20 | 1.44 | 1.73 | 2.07 | 2.49 | 2.99 | 3.58 | 4.30 | 5.16 | 6.19 | 7.43 | 8.91 | 10.7 | 12.8 | 15.4 | 18.5 | 22.2 | 26.6 |
| 1.21 | 1.46 | 1.77 | 2.14 | 2.59 | 3.14 | 3.80 | 4.60 | 5.56 | 6.73 | 8.14 | 9.85 | 11.9 | 14.4 | 17.4 | 21.1 | 25.6 | 30.9 |
| 1.22 | 1.49 | 1.82 | 2.22 | 2.71 | 3.31 | 4.03 | 4.91 | 5.98 | 7.30 | 8.91 | 10.9 | 13.3 | 16.2 | 19.7 | 24.1 | 29.4 | 35.9 |
| 1.23 | 1.51 | 1.86 | 2.29 | 2.82 | 3.46 | 4.26 | 5.24 | 6.44 | 7.93 | 9.75 | 12.0 | 14.8 | 18.1 | 22.3 | 27.5 | 33.8 | 41.6 |
| 1.24 | 1.54 | 1.91 | 2.37 | 2.93 | 3.63 | 4.51 | 5.58 | 6.92 | 8.59 | 10.7 | 13.2 | 16.4 | 20.2 | 25.2 | 31.2 | 38.7 | 48.0 |
| 1.25 | 1.56 | 1.95 | 2.44 | 3.05 | 3.81 | 4.77 | 5.96 | 7.45 | 9.31 | 11.6 | 14.6 | 18.2 | 22.7 | 28.5 | 35.5 | 44.4 | 55.6 |
| 1.26 | 1.59 | 2.00 | 2.50 | 3.14 | 4.00 | 5.04 | 6.34 | 8.00 | 10.1 | 12.7 | 16.0 | 20.2 | 25.4 | 32.0 | 40.4 | 50.9 | 64.1 |
| 1.27 | 1.61 | 2.05 | 2.56 | 3.23 | 4.10 | 5.16 | 6.49 | 8.18 | 10.3 | 13.0 | 16.4 | 20.7 | 26.0 | 32.8 | 41.3 | 52.1 | 65.6 |
| 1.28 | 1.64 | 2.10 | 2.69 | 3.44 | 4.40 | 5.57 | 7.00 | 8.82 | 11.1 | 14.0 | 17.6 | 22.2 | 28.0 | 35.2 | 44.4 | 56.0 | 70.5 |
| 1.29 | 1.66 | 2.15 | 2.76 | 3.57 | 4.61 | 5.85 | 7.36 | 9.27 | 11.7 | 14.8 | 18.6 | 23.4 | 29.5 | 37.2 | 46.9 | 59.1 | 74.4 |
| 1.30 | 1.69 | 2.20 | 2.86 | 3.71 | 4.83 | 6.27 | 8.16 | 10.6 | 13.8 | 17.9 | 23.3 | 30.3 | 39.4 | 51.2 | 66.5 | 86.5 | 112 |
| 1.31 | 1.72 | 2.25 | 2.95 | 3.86 | 5.04 | 6.62 | 8.67 | 11.4 | 14.9 | 19.5 | 25.5 | 33.5 | 43.8 | 57.4 | 75.2 | 98.5 | 129 |
| 1.32 | 1.74 | 2.30 | 3.04 | 4.01 | 5.29 | 6.98 | 9.22 | 12.2 | 16.1 | 21.2 | 28.0 | 36.9 | 48.8 | 64.4 | 85.0 | 112 | 148 |
| 1.33 | 1.77 | 2.35 | 3.13 | 4.17 | 5.54 | 7.36 | 9.80 | 13.0 | 17.3 | 23.0 | 30.6 | 40.7 | 54.2 | 72.1 | 95.9 | 128 | 170 |
| 1.34 | 1.80 | 2.41 | 3.23 | 4.32 | 5.79 | 7.76 | 10.4 | 13.9 | 18.7 | 25.0 | 33.5 | 44.9 | 60.2 | 80.6 | 108 | 145 | 194 |
| 1.35 | 1.82 | 2.46 | 3.32 | 4.48 | 6.05 | 8.17 | 11.0 | 14.8 | 20.1 | 27.1 | 36.6 | 49.3 | 66.6 | 90.2 | 122 | 164 | 222 |
| 1.36 | 1.85 | 2.52 | 3.42 | 4.65 | 6.32 | 8.62 | 11.7 | 15.9 | 21.7 | 29.4 | 40.0 | 54.5 | 74.1 | 101 | 137 | 186 | 253 |
| 1.37 | 1.88 | 2.57 | 3.52 | 4.83 | 6.61 | 9.06 | 12.4 | 17.0 | 23.3 | 31.9 | 43.7 | 59.9 | 82.1 | 112 | 154 | 211 | 289 |
| 1.38 | 1.90 | 2.63 | 3.63 | 5.00 | 6.91 | 9.53 | 13.2 | 18.2 | 25.1 | 34.6 | 47.7 | 65.8 | 90.9 | 125 | 173 | 239 | 330 |
| 1.39 | 1.93 | 2.69 | 3.73 | 5.19 | 7.21 | 10.0 | 13.9 | 19.4 | 26.9 | 37.4 | 52.0 | 72.3 | 101 | 140 | 194 | 270 | 375 |
| 1.40 | 1.96 | 2.74 | 3.84 | 5.38 | 7.54 | 10.5 | 14.8 | 20.7 | 28.9 | 40.5 | 56.7 | 79.4 | 111 | 156 | 218 | 305 | 427 |
| 1.41 | 1.99 | 2.80 | 3.95 | 5.57 | 7.86 | 11.1 | 15.6 | 22.0 | 31.1 | 43.8 | 61.8 | 87.1 | 123 | 173 | 244 | 344 | 485 |
| 1.42 | 2.02 | 2.86 | 4.06 | 5.78 | 8.20 | 11.7 | 16.6 | 23.5 | 33.3 | 47.3 | 67.2 | 95.4 | 136 | 193 | 273 | 388 | 552 |
| 1.43 | 2.05 | 2.92 | 4.18 | 5.98 | 8.55 | 12.2 | 17.5 | 25.0 | 35.8 | 51.1 | 73.1 | 105 | 150 | 214 | 306 | 437 | 625 |
| 1.44 | 2.10 | 2.99 | 4.31 | 6.20 | 8.92 | 12.9 | 18.5 | 26.6 | 38.3 | 55.2 | 79.5 | 115 | 165 | 237 | 342 | 492 | 709 |
| 1.45 | 2.13 | 3.05 | 4.42 | 6.41 | 9.30 | 13.5 | 19.5 | 28.3 | 41.1 | 59.6 | 86.4 | 125 | 182 | 263 | 382 | 554 | |
| 1.46 | 2.16 | 3.11 | 4.54 | 6.63 | 9.69 | 14.2 | 20.7 | 30.2 | 44.0 | 64.3 | 93.8 | 137 | 200 | 292 | 426 | 622 | |
| 1.47 | 2.18 | 3.18 | 4.67 | 6.86 | 10.1 | 14.8 | 21.8 | 32.1 | 47.1 | 69.3 | 102 | 150 | 220 | 324 | 476 | 699 | |
| 1.48 | 2.19 | 3.24 | 4.81 | 7.11 | 10.5 | 15.6 | 23.0 | 34.1 | 50.4 | 74.6 | 110 | 164 | 242 | 356 | 530 | 784 | |
| 1.49 | 2.22 | 3.31 | 4.95 | 7.34 | 10.9 | 16.3 | 24.3 | 36.4 | 53.9 | 80.4 | 120 | 178 | 266 | 396 | 590 | 880 | |
| 1.50 | 2.25 | 3.38 | 5.06 | 7.59 | 11.4 | 17.1 | 25.6 | 38.4 | 57.7 | 86.6 | 130 | 195 | 292 | 438 | 657 | 985 | |
| 1.51 | 2.28 | 3.44 | 5.20 | 7.85 | 11.9 | 17.9 | 26.9 | 40.8 | 61.6 | 93.1 | 141 | 212 | 320 | 484 | 731 | 1,130 | |
| 1.52 | 2.31 | 3.51 | 5.34 | 8.11 | 12.3 | 18.8 | 28.5 | 43.3 | 65.8 | 100 | 152 | 231 | 351 | 534 | 812 | 1,234 | |
| 1.53 | 2.34 | 3.58 | 5.48 | 8.38 | 12.8 | 19.6 | 30.0 | 45.9 | 70.3 | 108 | 165 | 252 | 385 | 589 | 902 | 1,380 | |
| 1.54 | 2.37 | 3.65 | 5.62 | 8.66 | 13.3 | 20.5 | 31.6 | 48.7 | 75.0 | 116 | 178 | 274 | 422 | 650 | 1,001 | 1,541 | |

| R | $R^{19}$ | $R^{20}$ | $R^{21}$ | $R^{22}$ | $R^{23}$ | $R^{24}$ | $R^{25}$ |
|---|---|---|---|---|---|---|---|
| 1.15 | 14.2 | 16.4 | 18.8 | 21.7 | 24.9 | 28.6 | 32.9 |
| 1.16 | 16.8 | 19.5 | 22.6 | 26.2 | 30.6 | 35.2 | 40.8 |
| 1.17 | 19.8 | 22.7 | 26.2 | 30.6 | 35.7 | 41.6 | 48.6 |
| 1.18 | 23.2 | 27.2 | 31.6 | 37.0 | 43.3 | 50.7 | 59.4 |
| 1.19 | 27.3 | 32.0 | 37.4 | 43.9 | 51.6 | 60.5 | 71.0 |
| 1.20 | 32.0 | 37.4 | 43.9 | 51.6 | 60.6 | 71.2 | 83.6 |
| 1.21 | 37.4 | 43.9 | 51.6 | 60.6 | 71.2 | 83.6 | 98.2 |
| 1.22 | 43.7 | 51.6 | 60.6 | 71.2 | 83.6 | 98.2 | 115 |
| 1.23 | 51.1 | 60.6 | 71.2 | 83.6 | 98.2 | 115 | 135 |
| 1.24 | 59.6 | 71.2 | 83.6 | 98.2 | 115 | 135 | 159 |
| 1.25 | 69.5 | 83.6 | 98.2 | 115 | 135 | 159 | 187 |
| 1.26 | 80.7 | 98.2 | 115 | 135 | 159 | 187 | 219 |
| 1.27 | 93.8 | 115 | 135 | 159 | 187 | 219 | 257 |
| 1.28 | 109 | 135 | 159 | 187 | 219 | 257 | 302 |
| 1.29 | 126 | 159 | 187 | 219 | 257 | 302 | 354 |
| 1.30 | 146 | 187 | 219 | 257 | 302 | 354 | 416 |
| 1.31 | 169 | 219 | 257 | 302 | 354 | 416 | 488 |
| 1.32 | 195 | 257 | 302 | 354 | 416 | 488 | 573 |
| 1.33 | 226 | 302 | 354 | 416 | 488 | 573 | 673 |
| 1.34 | 260 | 354 | 416 | 488 | 573 | 673 | 790 |
| 1.35 | 299 | 416 | 488 | 573 | 673 | 790 | 928 |
| 1.36 | 345 | 488 | 573 | 673 | 790 | 928 | 1,090 |
| 1.37 | 396 | 573 | 673 | 790 | 928 | 1,090 | 1,280 |
| 1.38 | 455 | 673 | 790 | 928 | 1,090 | 1,280 | 1,503 |
| 1.39 | 523 | 790 | 928 | 1,090 | 1,280 | 1,503 | 1,765 |
| 1.40 | 601 | 928 | 1,090 | 1,280 | 1,503 | 1,765 | 2,073 |
| 1.41 | 691 | 1,090 | 1,280 | 1,503 | 1,765 | 2,073 | 2,434 |
| 1.42 | 795 | 1,280 | 1,503 | 1,765 | 2,073 | 2,434 | 2,858 |
| 1.43 | 914 | 1,503 | 1,765 | 2,073 | 2,434 | 2,858 | 3,356 |
| 1.44 | 1,051 | 1,765 | 2,073 | 2,434 | 2,858 | 3,356 | 3,940 |
| 1.45 | 1,208 | 2,073 | 2,434 | 2,858 | 3,356 | 3,940 | 4,626 |
| 1.46 | 1,389 | 2,434 | 2,858 | 3,356 | 3,940 | 4,626 | 5,432 |
| 1.47 | 1,597 | 2,858 | 3,356 | 3,940 | 4,626 | 5,432 | 6,378 |
| 1.48 | 1,836 | 3,356 | 3,940 | 4,626 | 5,432 | 6,378 | 7,489 |
| 1.49 | 2,111 | 3,940 | 4,626 | 5,432 | 6,378 | 7,489 | 8,793 |
| 1.50 | 2,428 | 4,626 | 5,432 | 6,378 | 7,489 | 8,793 | 10,325 |
| 1.51 | 2,792 | 5,432 | 6,378 | 7,489 | 8,793 | 10,325 | 12,123 |
| 1.52 | 3,210 | 6,378 | 7,489 | 8,793 | 10,325 | 12,123 | 14,236 |
| 1.53 | 3,692 | 7,489 | 8,793 | 10,325 | 12,123 | 14,236 | 16,717 |
| 1.54 | 4,246 | 8,793 | 10,325 | 12,123 | 14,236 | 16,717 | 19,631 |

Of course we could have used somewhat smaller gears, with 9 or even 8.75 in. center distance, but then the pinion *J* would have been that much smaller, and the spindle consequently weaker.

The safe working load on the teeth of gear *M* will be 2,350 lb. at the highest circumferential velocity, which will be about 400 ft. per min., and 3,700 lb. at the lowest velocity, about 32 ft. per min. This is

**Table III—Theoretical and Actual Spindle Speeds**

| Counter-speeds, r.p.m. | Back Gear | | Back Gear | | Open Belt | |
|---|---|---|---|---|---|---|
| | Calculated | Actual | Calculated | Actual | Calculated | Actual |
| n = 165 | 8 | 8 | 32 | 32.3 | 128.5 | 131 |
| | 10.1 | 10 | 40.4 | 40.8 | 162 | 165 |
| | 12.7 | 12.7 | 50.8 | 51.2 | 204 | 208 |
| N = 330 | 16 | 16 | 64 | 64.6 | 257 | 262 |
| | 20.2 | 20 | 81 | 81.6 | 324 | 330 |
| | 25.4 | 25.4 | 102 | 102.4 | 408 | 416 |

based on a safe stress at zero velocity of 20,000 lb. per sq.in. The face is assumed to be three times the circular pitch, or 2.25 inches.

In order to find what size of cut can be taken on a certain diameter, say 20 in. in soft cast iron, we find that the pressure on the tool will be $\frac{3{,}700 \times 7.5}{10}$, or nearly 2,800 lb. According to Taylor's experiments, a cut $\frac{1}{4}$x$\frac{1}{8}$ in. will take 2,900 lb. while a cut $\frac{1}{4}$x$\frac{3}{8}$ in. takes 2,800 pounds.

Assuming 60 ft. per min. cutting speed, the corresponding net horsepower will be

$$HP = \frac{60 \times 2{,}800}{33{,}000} = 5.1.$$

The width of belt may be found from the formula:

$$HP = \frac{D\,W\,N}{C}$$

$D$ = Diam. of pulley in in.
$W$ = Width of belt in in.
$N$ = R.p.m.
$C$ = Constant.

For double leather belting, $C$ may be taken at 2,000 to 2,400. With the last value the belt need not be so tight and will, of course, last longer. Making allowance for frictional losses in bearings and gearing, the horsepower transmitted by the belt may be taken at 5.5. Assuming a value of $C$ of 2,200, and using the slow counterspeed for $N$, we then get

$$W = \frac{5.5 \times 2{,}200}{15 \times 162} = 5 \text{ in.}$$

The slip of belt may amount to 2 or 3 per cent, and to compensate for this, the counterspeeds $n$ and $N$ should be increased to, say 165 and 330 r.p.m. respectively.

On account of the back gear ratios being a trifle higher than the correct values, the actual spindle speeds will vary a little from the theoretically correct ones but, as will be seen from Table III, the difference is very small.

## Larger Letters Needed on Packing Cases

The stencil marking done by Americans is, generally speaking, too small, according to reports from abroad received by the Department of Commerce. Even large cases are marked with 1-in. stencils. Our competitors make a specialty of marks from 3 to 5 in. high, the consignee's mark and destination being legible at 200 yards, in contrast to the usual American marks of 1-in. or 1½-in. stencil marking.

# Pipe Dreams of a Tramp Machinist

## *What Ailed the Leadscrew*

By Glen Quharity

"S'MATTER with the babbitt you're givin' us lately, Tom?" querulously inquired the foreman of Dep't 11 of the Brookdell Co., of Thomas Jones, Esq., who was privileged to sign his name on the company's stationary over the title of Master-Mechanic.

"Same ol' babbitt, Harry," responded Tom; "What's the matter with you?"

"Why! you know that special machine we have just set up in our room?"

"Yes! What about it?"

"It has a slide that is moved back and forth by a screw, and that screw is the same as our regular leadscrews, except in length; 1¾ in. in diameter, 4 pitch, single Acme thread. The screw works in a solid babbitt nut and traverses the slide eight feet each way about once a minute or so. We set it up day before yesterday and started it up to run it in. In just 25 min. the nut stripped."

"Nut's too tight," declared Tom. "You ought to free it up before you try to run it in."

Harry Defends His Methods

"Poured on our regular mandrel and tapped with our regular taps," replied the foreman. "Can turn it on the screw easy by hand. Don't shake; just a nice smooth fit, same as our standard leadscrews and nuts."

"Slide moves too hard. Why don't you ease it up and make a new nut?" suggested Tom.

"Can push it the whole length with one hand. As for a new nut, we've made four. Every one of 'em stripped inside of a half-hour. Here's the latest"—and the foreman held out an object that had the appearance of a coil spring with a wire-section like an Acme thread turned inside out. The "spring" was about 4 in. long, 4 pitch, and was in fact the thread of the babbitt nut, broached clear of the backing metal.

"The screw that did that was never cut on our precision machines," said Tom, emphatically. "The lead is too fast or too slow."

Suspicion Points to the Lathe on Which the Screw Was Cut

"No! it was made on the old lathe that we used to cut screws on before we built the precision machines. This special machine did not require a screw of extreme accuracy and I thought the lathe was good enough. We couldn't stop production on one of the regular machines and bust it up for a special job, and, anyway, what's the diff? If the nut fits in one place it will fit as well in any other place, even if the lead *is* a trifle out. Besides, this screw is 9 ft. long and has got exactly 432 turns of thread on it; we counted 'em."

"Well! I suppose you know what you're talking about," said Tom. "Make a new nut of special hard babbitt and see that you fit it to turn easy on the screw. When you're ready to start, let me know; I want to see what happens. I'll have this babbitt tested."

The new nut was made, Tom was called to witness the trial, and the machine was started. In exactly 20 min. by the watch the slide stopped moving and a

new coil spring of babbitt began slowly to push its way out of the nut.

"Take out that dam screw and send it to the lead-testing machine P.D.Q." shouted Tom. (We didn't say S.O.S., or pronto, in those days.) "There ain't anything the matter with the babbitt."

The screw was taken out, cleaned up, and started for the testing room, but before it got there Tom had a change of heart and ordered it back to the lathe upon which it was cut. Said he, "didn't want those darned inspectors to give him the merry ha-ha until he knew what it was about."

### Testing the Lathe

The old lathe in question had been a good one in its day; in fact it had been selected as the best machine obtainable for the purpose at a time when people were less fussy in the matter of such trifling details as pitch and lead. It had been stripped of all feed mechanism, as its sole duty was the cutting of leadscrews, but the handwheel and pinion had been left in place for convenience in traversing the carriage when setting up. It was used now—when used at all—for the purpose of roughing out lead screws, thus relieving the precision machines of a part of their burden.

Tom ran the carriage back and forth by hand a few times and found that it ran easily, without any appreciable hard spots; tested the carriage for side shake; tried the cross-slide to see if there was any movement in it that ought not to be there; put a stick under the spindle nose and tried to shake the spindle in its bearings; hunted for chips in the tooth spaces of the change gears; in short he tried every test he could think of to prove the lathe at fault, but to no purpose. The lathe was all right.

The only things that could possibly be considered wrong were that there was considerable backlash between the screw and nut, and that the carriage moved a trifle easier as it approached the headstock—which was to be expected, as the lathe had been in service for years and the screws cut by it were not all of the same length.

### The Lathe Caught in a Trick

Before putting the suspected screw into the lathe, Tom leaned back against a convenient bench and watched a workman rough out a new screw. This took quite a long time and Tom appeared to a casual observer to be having a protracted resting spell, but all the time he was thinking—which was what he drew a substantial salary for doing. He was trying to catch that lathe at some trick that would account for a local error in its product.

The traverse handwheel turned very freely, because of long usage, and Tom noticed that every time the handle in this wheel passed over the top center and started on its down-hill journey the wheel would make a little jump forward. "I wonder," ruminated Tom, "if such a little darned thing as that could possibly affect the position of that heavy carriage. Not under a cut, anyhow."

Tom decided, however, to balance the wheel. He took a stock handle of about the same size, put it on the scales and balanced it with a piece of solder wire; snipping off the end of the wire until the handle overbalanced by an amount that he guessed would equal the weight of the threaded shoulder where it screwed into the rim of the wheel. Wrapping the wire around the rim at a point opposite the handle, Tom noted with satisfaction that the erratic movement disappeared. He also took the precaution to measure the advance of the carriage per revolution of the handwheel, and found it to be 1⅛ inches.

### Tom Proves His Original Theory that the Screw Was at Fault

Putting the suspected screw on centers, Tom set in an Acme threading tool and proceeded to scrape over the length of the thread. For the first four or five feet nothing happened. As the carriage approached the headstock, however, the tool began to take small scabs, or scales, off one side of the thread at intervals, and these intervals, as he found by measuring along the axis, were 1⅛ in. apart; the spots sweeping around the circumference of the screw in a long helix for two or three feet of its length.

Running the tool again and again over the screw, Tom gradually reduced it to something like a smooth and even lead. As nearly as he could measure the thickness of the successive chips with his micrometer, the "humps" were about 0.006 in. high.

Returning the screw to the machine in which it belonged, a new nut was made and there was no further trouble from stripping. It was a long time, however, before Tom would tell anybody what he had found—said he was afraid nobody would believe him—but before sundown an order had gone forth from his office; which order is the reason why all of our handwheels are now in balance *after the handles are in.*

## Increasing Speed of Welding

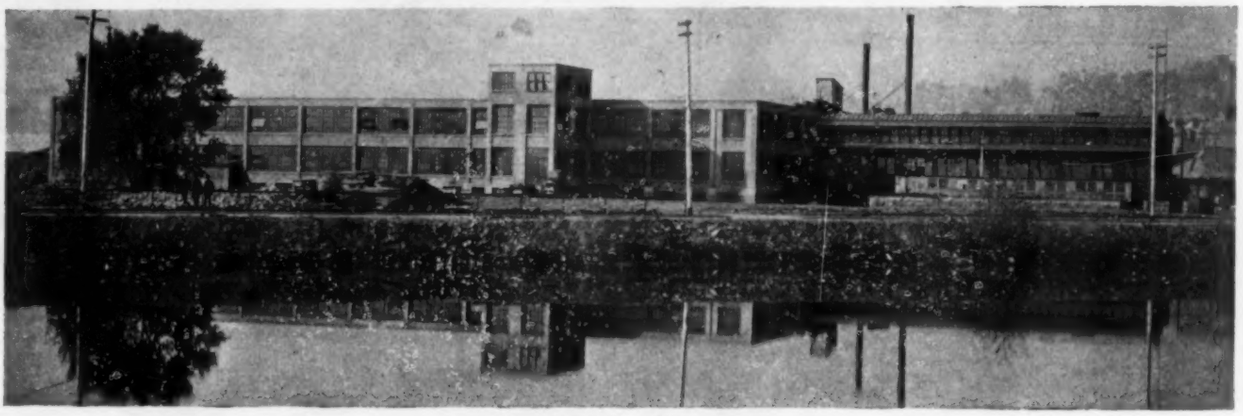
By H. A. Woofer
Electrical Engineer, Thompson Electric Welding Co.

Many users of welders are installing oversized transformers in butt welders, to enable them to do bigger and faster work. There are many advantages, and only one disadvantage in this practice. For example, a butt welder was recently sold to flash-weld ¾-in. diameter hand cranks for automobiles. The welder was of 15 kw. capacity, and made the welds in an actual welding time of six seconds each. This, however, was not fast enough to meet the production demands of the customer. Accordingly, a 50-kw. transformer was installed in a welder, which welded the cranks in two seconds. The advantages in this case were increased production, a stronger weld, and a decreased amount of burr or extrusion left on the crank, to be removed.

The disadvantage of this and all similar cases, is the larger standby charge made by the local power company to cover 50 kw., instead of 15 kw., of power installation. But the old law, "You can't get something for nothing," applies to electric welders as well as to all other machinery. To do the same size work in half the time requires twice the kilowatts. The reverse of this statement is also true. Hence, it becomes matters of production and local power conditions, whether a large or small welder should be installed in any given plant. The tendency, however, is for more rapid production, regardless of standby charges.

An example of speed was the welding of two port lugs on each cylinder head of the Liberty engines, in from 2 to 2½ min. per cylinder.

From a paper read before Boston Section, American Welding Society, Oct. 1923.



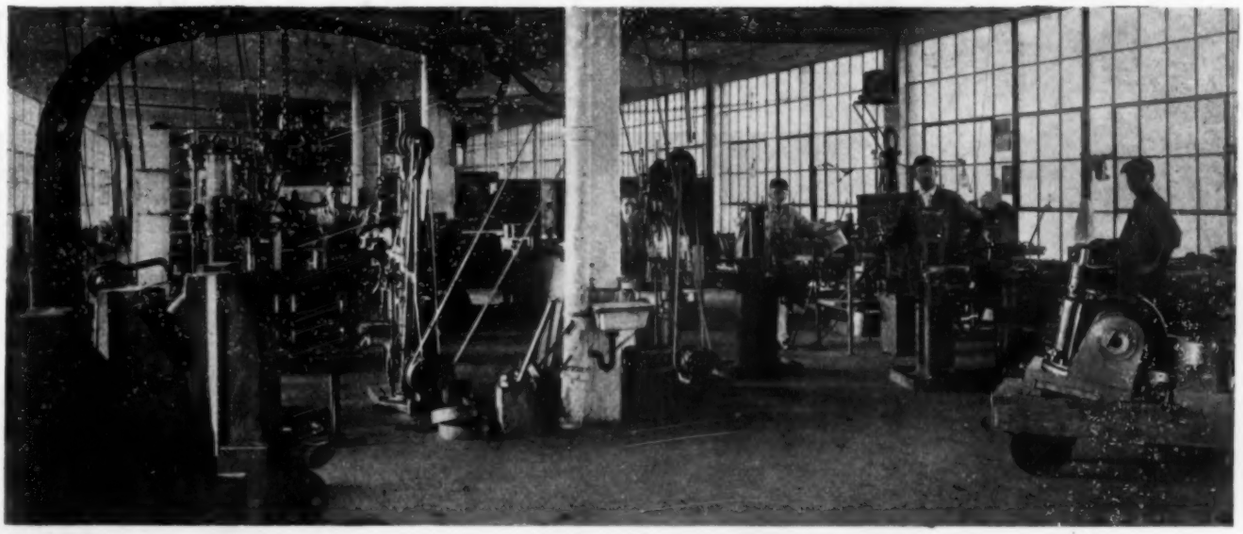
*The plant at Dubuque*

# *Where Machine Tools Are Made*

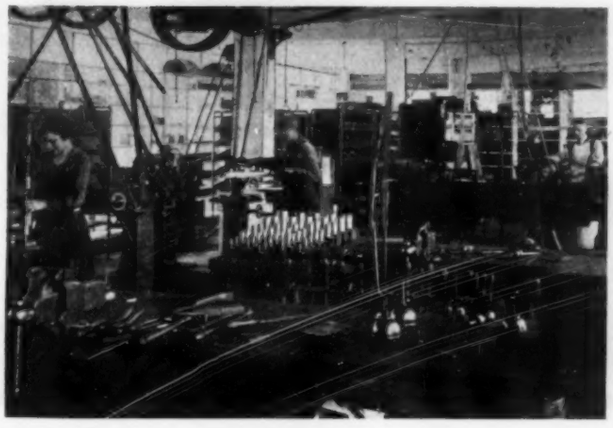
**The Adams Company**

Established 1883

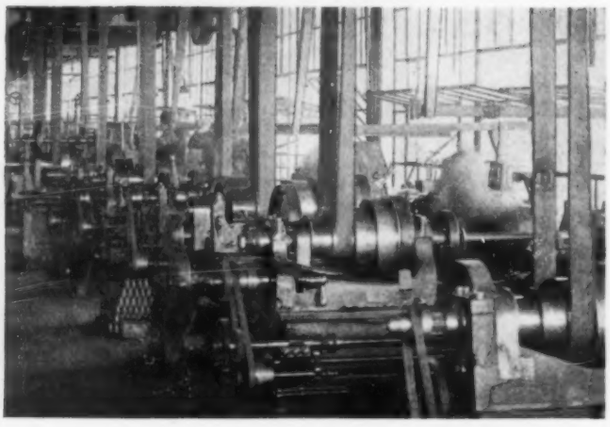
*Machine assembly floor*

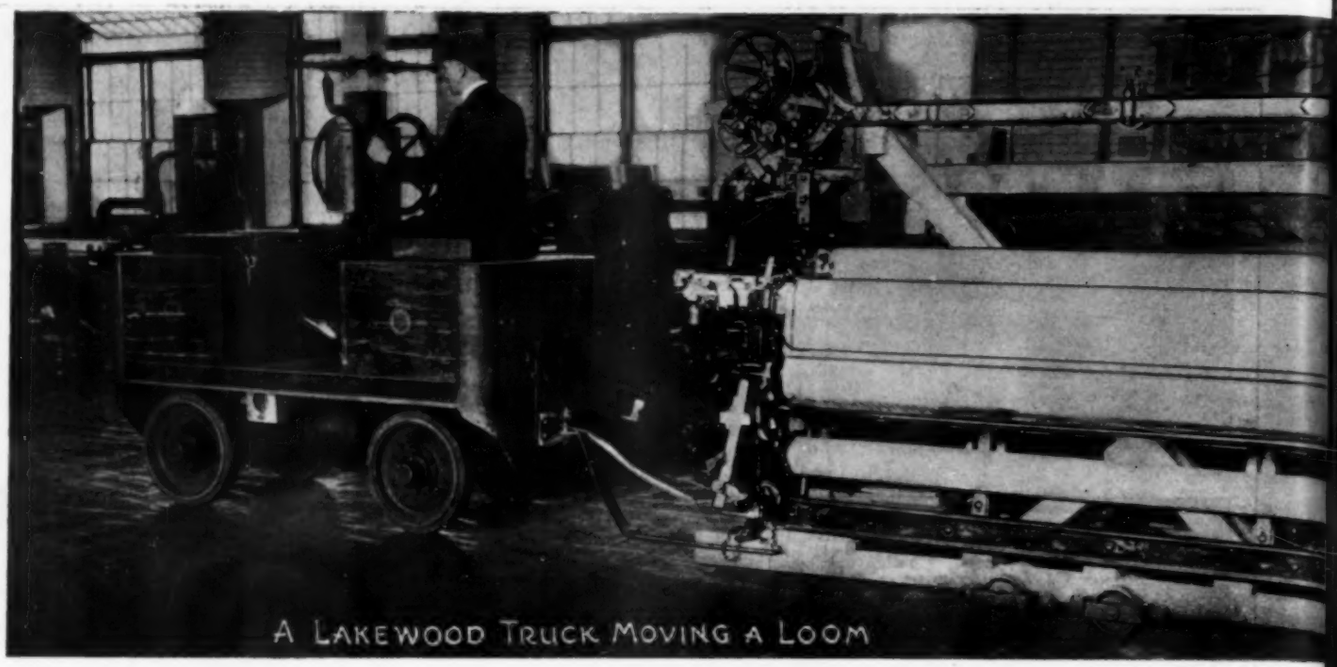


*Tool room*



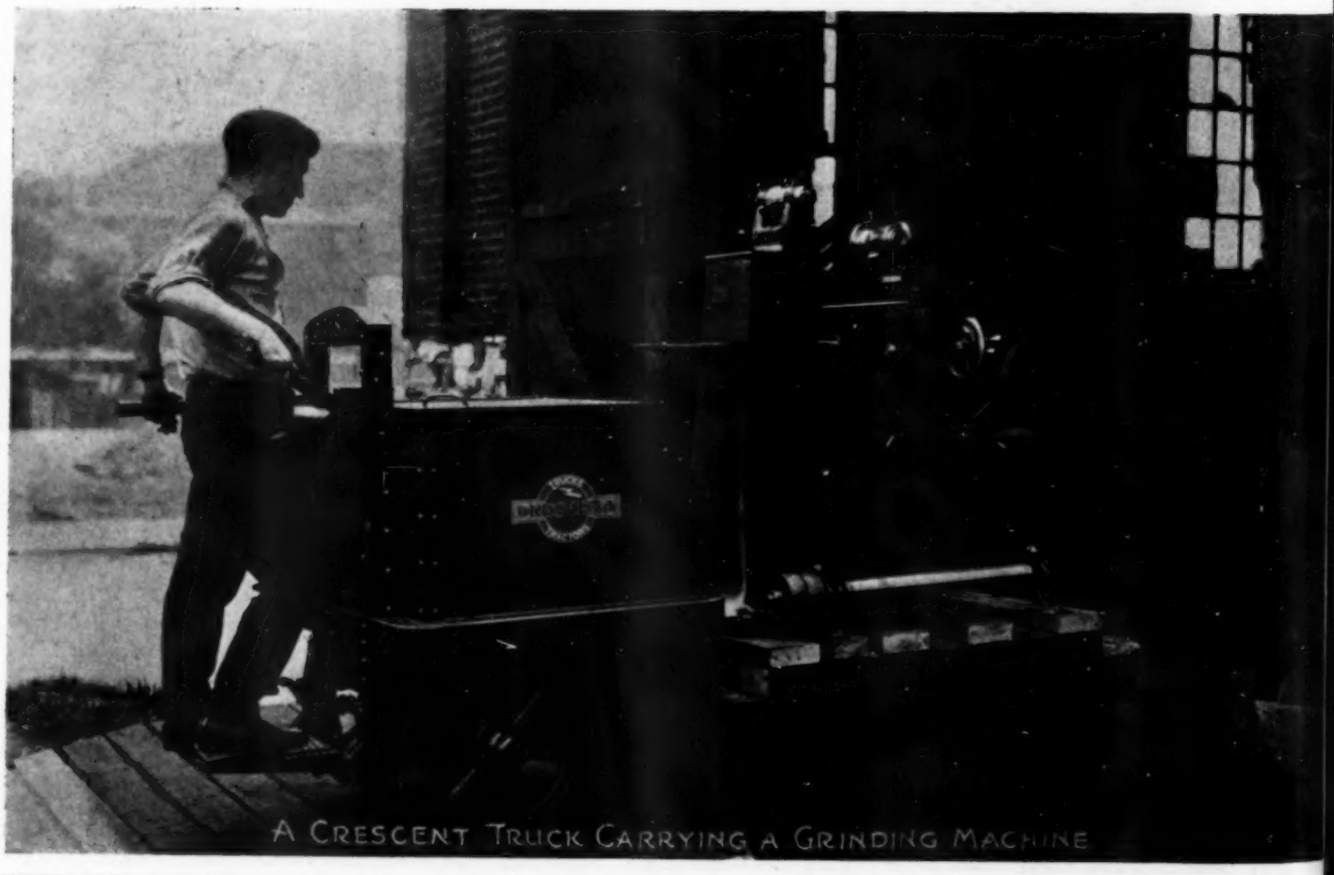
*Lathe department*



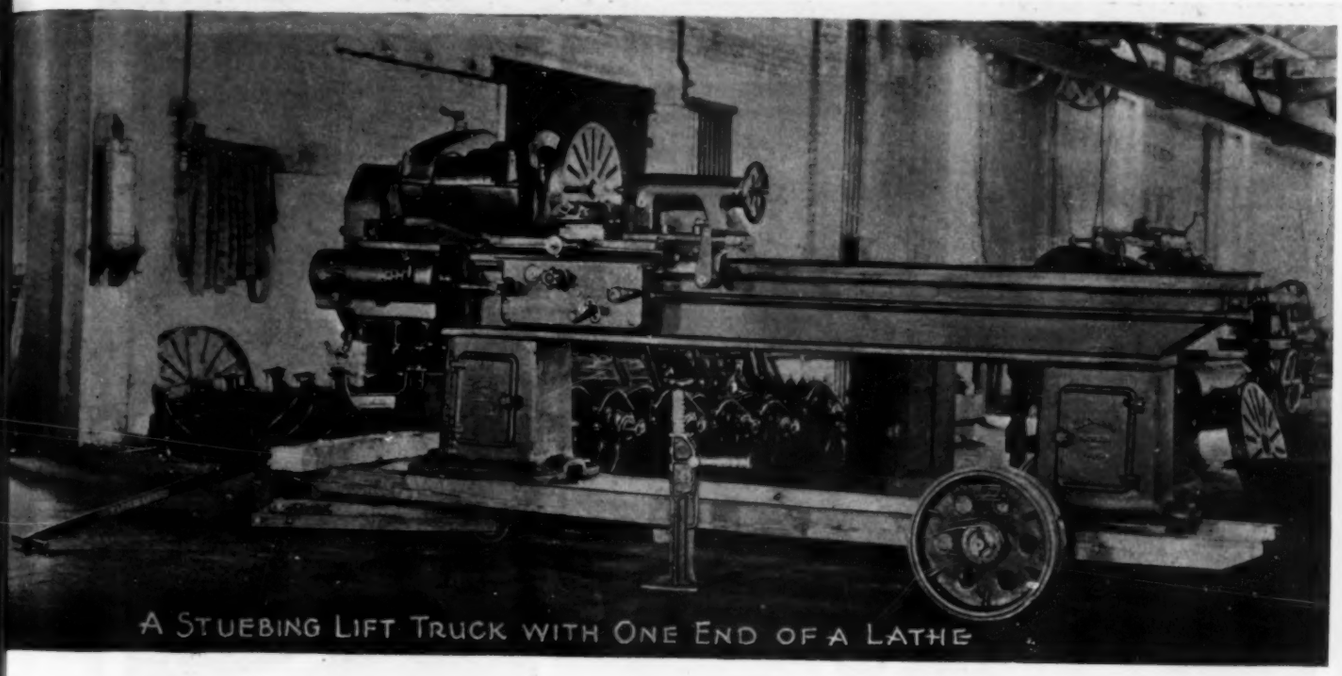


A LAKEWOOD TRUCK MOVING A LOOM

# IMMIGRATION—
## The Industrial Truck Saves Labor



A CRESCENT TRUCK CARRYING A GRINDING MACHINE

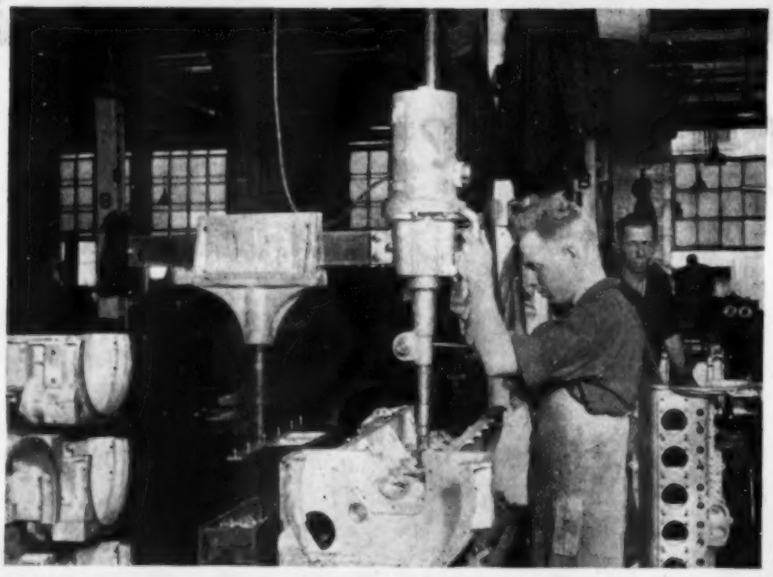


A STUEBING LIFT TRUCK WITH ONE END OF A LATHE

# OR MACHINERY?

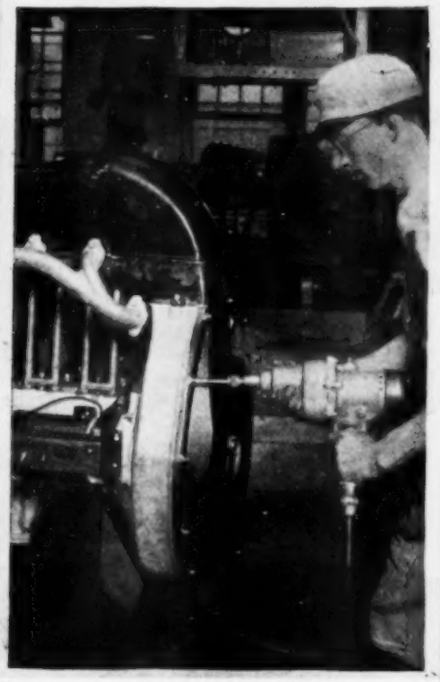
## When Machinery Has To Be Moved

A TOWMOTOR PULLING A SHEAR ON ROLLERS



## *Nut Drivers in the Franklin Plant*

Screw Driving, Nut Driving and Facing speeded up by use of Electric Tools



# Characteristics of the Ring Spring

By Oscar R. Wikander

A recently developed spring—Material stressed in pure tension and compression under load—Calculations for theoretical pressure — Test results in railway work

IN SPRINGS of all usual designs, the material is subjected to bending or torsion and their capacity is limited to their volume. Any increase in their capacity to absorb energy can be obtained only by means of a corresponding increase in volume, which is, however, frequently impossible due to lack of available space. A change in the nature of the stresses to which the material is subjected is frequently the only way whereby such an increase in capacity can be obtained.

Due to the fact that pure tension and compression stresses lead to a far more complete utilization of the material, spring experts have for a long time been trying to design a spring in which only such stresses occur. These efforts have finally led to the invention of the ring spring, the first design in which all parts are uniformly subjected to tension or compression stresses. This design has been patented in all civilized countries.

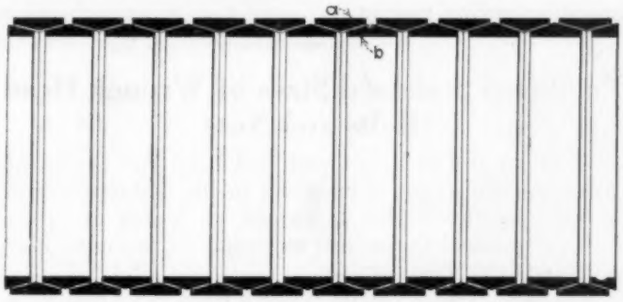



*Fig. 1—Longitudinal section of the ring spring*

As illustrated in Fig. 1, the spring consists of inner and outer solid rings, *a* and *b*, which fit into each other along conical surfaces. When axial pressure is applied the outer rings are subjected to tensile stresses and the inner rings to compression stresses, always within the elastic limit of the material. On account of the deformation of the rings which occurs, they slip into each other and a spring action in the direction of the longitudinal axis of the spring is obtained.

An important feature is that the relative motion of the rings is also opposed by a considerable friction between the conical surfaces, which materially increases the spring reaction during compression and exerts a retarding action during the recoil at release. This property is of particular value in all devices where a great amount of energy must be accumulated and, as far as possible, consumed. Pulling and pushing devices for railroad cars (drawbar springs) are a case in point.

The continuous increase in railroad car sizes and load capacities requires a corresponding increase in the energy-absorbing capacity of the drawbar springs. When ordinary springs are used, the increase in energy-absorbing capacity will be accompanied by a corresponding increase in the power of recoil which, in turn, increases the danger of train ruptures. Torsion and bending springs cannot be made as effective as the ring springs within the available space, and have the further disadvantage that they set or break easily. They are, therefore, not suitable for large capacities.

### Each Section in Tension or Compression

The ring spring is a pure tension and compression spring. Each section is uniformly subjected in all its fibers to tension or compression and for this reason alone the ring spring can absorb about three times more energy than any other type of spring. There is also so much internal friction that the force of compression must be increased about 70 per cent above its theoretical value, in order to actuate the spring. The force of recoil decreases, on the other hand, about 60 per cent below the theoretical value. The friction thus increases the energy-absorbing capacity of the ring spring to about five times that for usual springs, allowing the same maximum stress of the material.

It is thus possible by the use of ring springs, particularly if they are concentrically arranged, one within the other, to create a very powerful accumulator of energy which, however, returns only about one quarter of the energy absorbed. If a ring element should become defective, the action of the spring as a whole is only slightly weakened, and only the damaged ring needs to be replaced. It is also possible to make the spring softer or stiffer by the adding or removal of one or several rings.

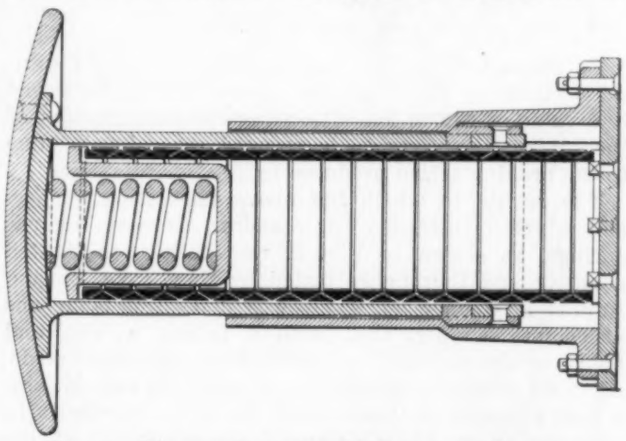


*Fig. 2—Ring spring assembled in a car bumper*

In order to further illustrate the operation of the

ring spring, we will show briefly how it is calculated and for this calculation the following formula is used:

$$D' - D \quad \frac{D \times K}{E}$$

$D$ = Mean diameter of the unexpanded outer ring
$D'$ = Mean diameter of the expanded outer ring
$E$ = Modulus of elasticity of the material
$K$ = Maximum allowable stress in lb. per sq.in.

For the spring illustrated in Fig. 1, $D = 7.6$ in. The modulus of elasticity of hardened steel is 28,300,000 lb. per sq.in. and, if we assume K = 142,000 lb. per sq.in., we find:

$$D' - D = \frac{7.6 \times 142{,}000}{28{,}300{,}000} = 0.0382 \text{ in.}$$

The outer ring has thus increased its diameter 0.0382 in. and the inner ring decreases in diameter a little less. The method of calculation is the same as for the outer ring, and we find that the compression on the diameter of the inner ring amounts to 0.0366 in. If the rings were not displaced in a longitudinal direction, there would be a radial clearance between the conical surfaces amounting to 0.0374 in., but this clearance is taken up by a relative longitudinal displacement of the corresponding conical surfaces.

The cones in Fig. 1 have an inclination of 1 to 4 and, consequently, the axial displacement of two corresponding cones amounts to

$$4 \times 0.0374 = 0.1495 \text{ in.}$$

Considering that there are 23 corresponding pairs of conical surfaces, the total motion of the spring amounts to $23 \times 0.1495 = 3.44$ in., at a maximum stress of 142,000 lb. per sq.in. The following formula can also be derived:

$$P = \frac{V \times K^2}{f \times E}$$

$P$ = Theoretical final pressure of the spring, disregarding friction
$V$ = Volume of the spring in cu.in.
$f$ = Total compression of spring.

The value of $V$ is, in our case, 176 cu.in. and

$$P = \frac{176 \times 142{,}000^2}{3.44 \times 28{,}300{,}000} = 36{,}400 \text{ lb.}$$

On account of the friction created between the conical surfaces of the rings, the above force is increased to a value of 61,600 lb., but during the recoil motion of the spring, the pressure is reduced to 15,400 lb., due to the braking action produced by friction at release.

The spring to which the above calculation applies, and which is intended for standard German bumper springs, as shown in Fig. 2, was built in a limited quantity and thoroughly tested by the Brake Testing Bureau in Grunewald. This was done first by means of compressed air, then with a falling weight, and finally on the car itself, where collision tests were made. All tests showed complete accord with the calculations, a final pressure of about 62,000 lb. being recorded at a compression of 3½ in. Careful measurements of the expansion of the rings also checked with the calculated expansion. The energy-absorbing capacity of the spring, as tested by air pressure, was practically the same as that measured with the falling weight arrangement and the collision tests showed a marked superiority of the ring springs as compared with the ordinary bumper spring.

The exceedingly favorable test results induced the State Railway authorities to place a large order for the purpose of making service tests on a large scale. During extensive tests the conical surfaces with a taper of 1 in 4 did not get stuck, and wear of the surfaces occurred in a few spots only, due to the thorough hardening of the rings.

Doubts have been expressed as to whether the action of the spring would not be affected by the formation of rust, but such fears have been found to be groundless, if a suitable lubricant is used. The inner surfaces of the rings, as well as the conical contact surfaces, are hermetically closed against air and water, due to the initial pressure of the spring, and the narrow exposed conical surfaces of the inner rings can easily be kept free from rust by the use of a suitable lubricant.

Depending upon the available space, the energy-absorbing capacity of the spring can be increased at will and, by placing the calculated spring inside of the 50-ton spring, it is possible to obtain a final pressure of 78 metric tons with compression of 3.15 in. A space of 19.7 in. in length and 9.985 in. in diameter is required and, by further insertion of smaller springs, a final spring reaction of 100 metric tons, and a total energy-absorbing capacity of about 28,800 ft.-lb. can be obtained. Only fractions of these values have been obtained with usual springs, and this type of spring can be built for forces of any magnitude and corresponding spring motion.

## Proposed Standard Sizes of Wrench Head Bolts and Nuts

A single standard nut and bolt head for use in all American industries is proposed in the tentative report of Sub-Committee No. 2, formed on March 16, 1922, by the Sectional Committee on Standardization of Bolt, Nut and Rivet Proportions.

Sub-committee No. 2, on Wrench Head Bolts and Nuts, has investigated present practice in the manufacture and use of this product, both in the United States and foreign countries, and from the results of this investigation, has prepared tables of proposed standard sizes. The early work was carried on in co-operation with the National Screw Thread Commission, and that body has tentatively considered and favorably received the report.

The tentative report is offered for criticism and comment, in order that the dimensions finally recommended as standard may meet the approval of all, as far as practicable. The report, in pamphlet form, has been published by the sub-committee and is being distributed gratis, on request.

The work of foreign standardization committees has been considered and analyzed, but no attempt has been made to harmonize American and foreign practice.

Dimensions are given for both heavy and light nuts, thus conforming to the practice in the various industries, but the adoption of a single standard nut and bolt head is proposed. This proposal eliminates the heavy nut sizes below ⅞-in., with the single exception that the width across flats of the ⅞-in. bolt shall be 1½ instead of ⅞-inch.

The seven tables given with the report include: (1) Present standards, (2) finished square and hexagonal bolt heads and nuts, (3) rough, square and hexagonal bolt heads and nuts, (4) finished light nuts, (5) finished hexagonal and square machine screw nuts, (6) finished hexagonal and square capscrews and (7) wrench openings.

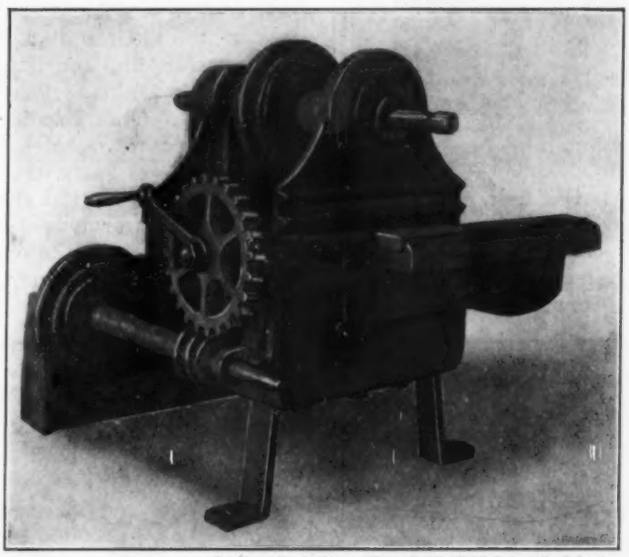
# Development of Machine Tools in New England

**By Guy Hubbard**

The thirteenth article—Examples of early milling machines—Development of the plain or Lincoln milling machine—The first universal milling machine — The edging or profiling machine

IN THE interchangeable system of manufacture, especially of guns, sewing machines, etc., the milling process is one of the most important and is likely to concern fully one third of the operations and machinery in such work. The general practice of milling is not so old as may be supposed; machines for milling having been regularly manufactured for the trade only since about 1850. The process is a direct outgrowth of the art of filing and it is not strange that the early milling cutters, such as those used by the French mechanic, Jacques de Vaucanson, about 1780, for cutting gear teeth, were nothing more or less than circular files. In fact as late as 1854, such circular files were still in use in American armories for taking light finishing cuts.

The milling machine, however, was actually of earlier introduction than the planer, and was in use in several forms by Colonel North of Middletown, Conn.; by Eli Whitney of Whitneyville, Conn.; and by Capt. John Harris Hall in the Hall shops at Harper's Ferry, prior to 1820. In its development, the Robbins & Lawrence Co. played a big part.



Courtesy Prof. H. L. Seward, Sheffield Scientific School

*Fig. 80—Eli Whitney's milling machine (1818)*

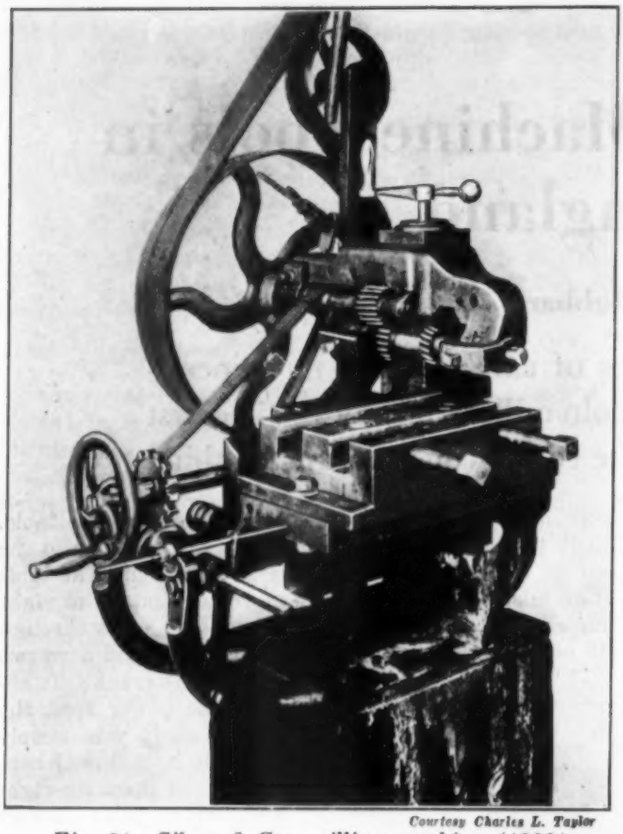
What is generally considered to be the first successful milling machine was built by Eli Whitney before 1818 and, after years of use in his Whitneyville armory, is preserved today at the Sheffield Scientific School of Yale University. This machine, which is illustrated in Fig. 80, has a cast-iron frame mounted upon a wooden block and a fixed spindle upon the tapered rear end of which was originally mounted the drive pulley (now missing). Within the headstock and also mounted directly upon the spindle, is a two-step cone pulley for a round belt which drives the feed mechanism.

The feed mechanism consists of a shaft hung at the front of the machine with the left bearing pivoted horizontally in a bracket, and the right bearing mounted upon a vertically sliding block at the end of the table. Upon the left end of this shaft is a mating cone to the one on the spindle, and at the right a worm. The table (now missing) was gibbed to move horizontally at right angles to the spindle and was driven by a screw through its center, the screw having at the front end a wormwheel and a crank. To engage the power feed, the tilting shaft was simply lifted up by a smooth handle turned upon its right end, which movement meshed the worm with the wormwheel and revolved the screw. The sliding block latched in place when the worm was engaged. The table was run back by disengaging the worm and turning the crank by hand.

About 1820, a more complete and highly developed milling machine was built at the shop of Silver & Gay, North Chelmsford, Mass. Workmen were constantly going back and forth between these old-time shops, and it is plainly evident that the Silver & Gay milling machine of 1820 was copied from the earlier one of Eli Whitney. The Silver & Gay machine, shown in Fig. 81, was in use until very recently. Its horizontal spindle was driven by reducing gears from the drive shaft, and the entire headstock was adjustable upon a vertical slide by means of a screw and ball crank. The table and feed mechanism are almost identical to those on the Whitney machine, except for a slight rearrangement of parts. There is but one speed to the feed, which is belted off the drive shaft. Idlers were employed to take up both drive and feed belts.

This machine was the one step between Eli Whitney the pioneer, and Robbins & Lawrence, who gave the manufacturing milling machine to the trade. Frederick W. Howe, as an apprentice, was familiar with the ancient machine of Silver & Gay, so when he began designing the Robbins & Lawrence milling machines at Windsor, about 1848, it is not strange that definite

For the author's forthcoming book. All rights reserved.



Courtesy Charles L. Taylor

*Fig. 81—Silver & Gay milling machine (1820)*

points of similarity appeared. His first effort in this direction was what Robbins & Lawrence called the plain "miller," now universally called the Lincoln milling machine, and one of the most important machine tools.

The Robbins & Lawrence (Howe's) machine was a basic design which sprang full fledged from the brain of the designer, as the original drawing, Fig. 82 (now hanging in the office of the Jones & Lamson Machine Co.), and photographs, Figs. 83 and 84, of one of the earliest models will prove. This machine has an adjustable spindle driven by a cone pulley and back gears, mounted

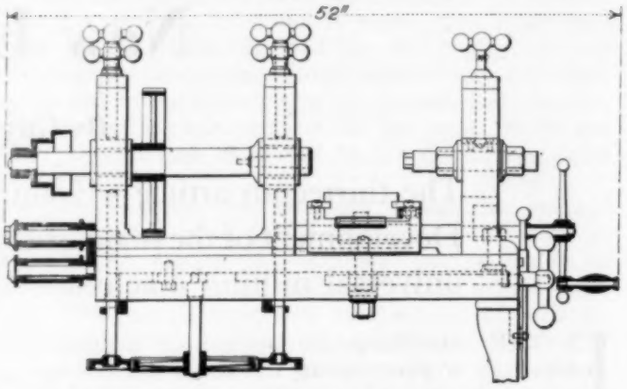
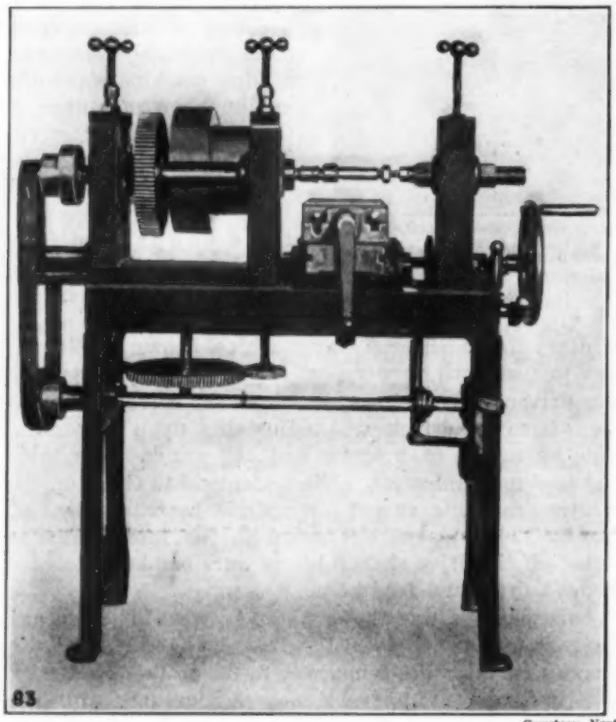
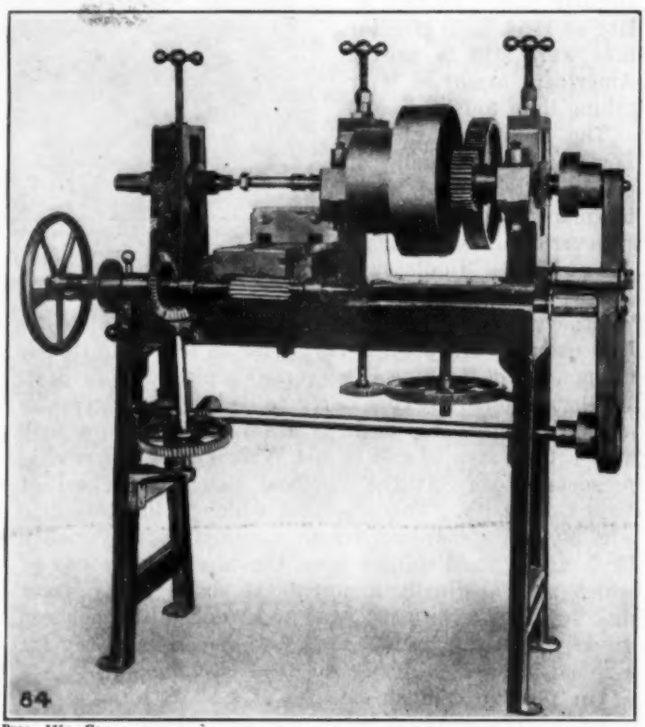



*Fig. 82—Robbins & Lawrence plain milling machine (1840)*
(From Howe's original design)

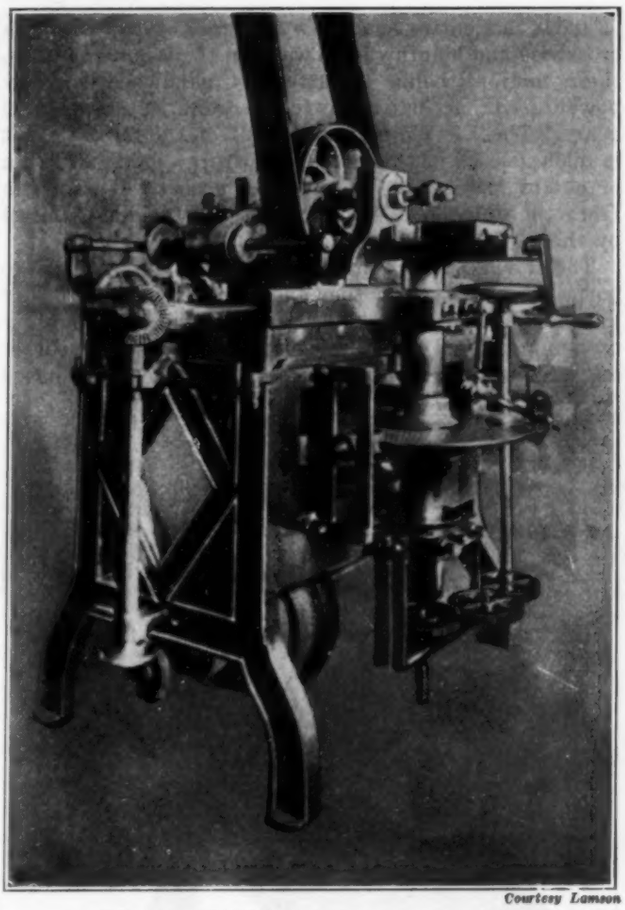
at the rear of the headstock upon sliding blocks to take care of the rising and falling adjustments. The power feed is the old familiar Eli Whitney type, adapted to the occasion, and consists of a tilting worm shaft beneath the machine, driven by a cone at the left end of the spindle. The table is operated by rack and pinion. The power feed operates the pinion shaft by means of reduction bevel gears, the pinion being upon the upper end of a nearly vertical shaft at the back of the machine and carries a wormwheel upon its lower end. To throw in the power feed, the operator pushes a lever at the right end of the machine, which tilts the worm shaft beneath the bed and thus meshes the worm into the

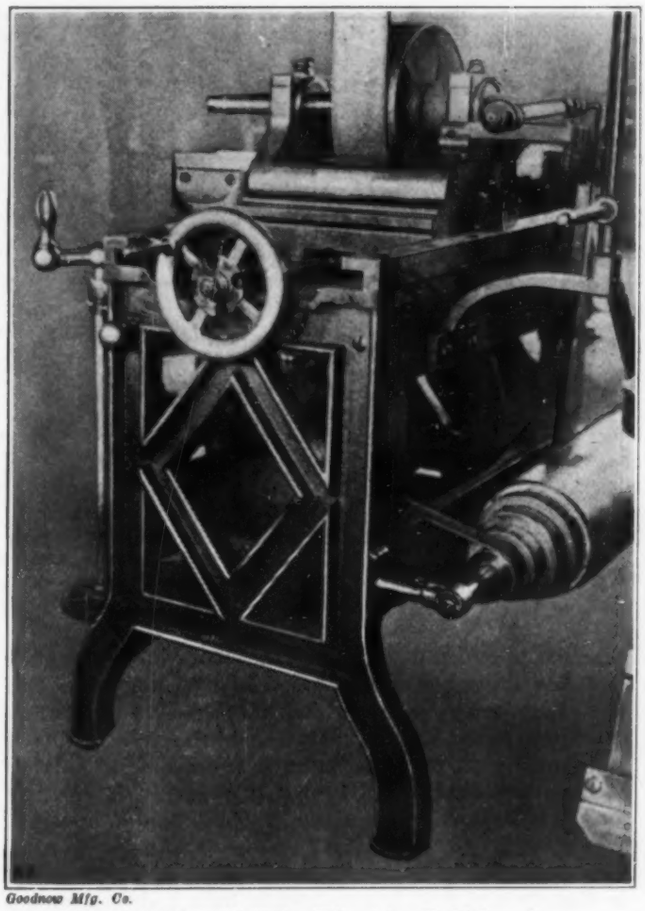



Courtesy North Bros. Mfg. Co.

*Fig. 83—Howe's original plain milling machine (1848). Front. Fig. 84—Howe's original plain milling machine (1848). Back*





Courtesy Lamson & Goodnow Mfg. Co.

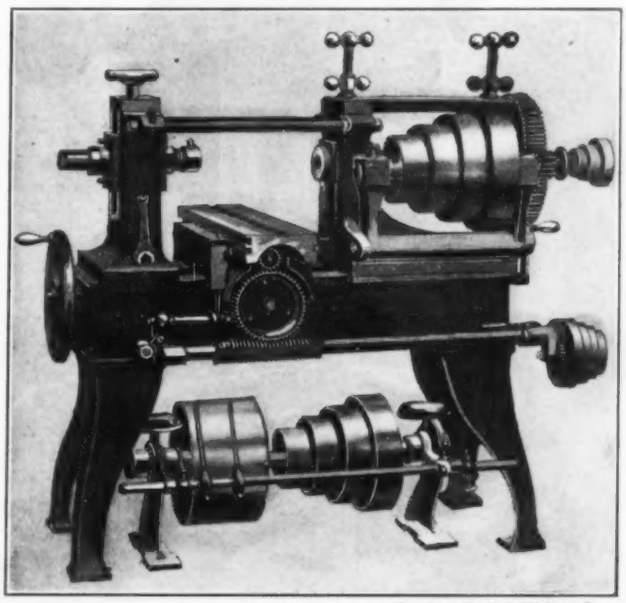
*Fig. 86—Robbins & Lawrence universal milling machine (1850). Front. Fig. 87—Robbins & Lawrence universal milling machine (1850). Back*

wormwheel. It is the Whitney feed mechanism—pure and simple.

This machine was the one brought to Hartford by Mr. Lawrence in 1852 and which was copied in 1855 by Francis A. Pratt of George S. Lincoln & Co. Mr. Pratt substituted a screw feed for the rack and pinion, and created the Lincoln milling machine of which no less than 200,000 have since been manufactured. See Fig. 85. Hundreds of the plain milling machines were built by Robbins & Lawrence—fifty-seven of them at $300 apiece being sent to the Enfield Armory in 1855. Many of the original plain milling machines of 1848-56 are still in use and are hard to detect among the modern ones. In the opinion of the writer, this very evident direct development from the Whitney machine of 1818 down to the Lincoln machine of modern times, is one of the most striking and important chapters in the history of the machine tool industry.

In 1850, Mr. Howe produced the Robbins & Lawrence universal milling machine illustrated in Figs. 86, 87 and 88, which was probably the first ever regularly manufactured for the trade. While not so refined in appearance as the first Brown & Sharpe universal milling machine, as shown in Fig. 89, this Windsor pioneer did its work in a very efficient manner, and was a long step in the direction of Joseph R. Brown's (Brown & Sharpe) machine, the design of which it undoubtedly influenced. It will be remembered that this last mentioned machine was originally designed and built for Mr. Howe for the purpose of fluting twist drills at the Providence Tool Co.'s plant.

The Robbins & Lawrence universal milling machine has a massive four legged cast-iron table, at the rear of and beneath which are the drums, cone pulleys, and gears of the feeding mechanism. On the top of the table is mounted the headstock, and at the front, the



Courtesy Pratt & Whitney Co.

*Fig. 85—Lincoln milling machine as developed by Francis A. Pratt*

Courtesy Lamson & Goodnow Mfg. Co.

*Fig. 88—Robbins & Lawrence universal milling machine in operation*

substantial column carrying the work-holding chuck and the indexing mechanism. Upon being unlocked, the column may be raised and lowered by an elevating screw, operated by a handwheel through a train of spur gears, and may be indexed by means of a large horizontal index plate drilled with numerous accurately spaced holes for the index pin, which is held in a swinging arm.

The horizontal spindle, upon which the drive pulley is directly mounted, is arranged to have a short forward and backward movement in the headstock, being operated by a hand lever when the sliding spindle is unlocked. The entire headstock is arranged to slide both crosswise and lengthwise in ways on the top of the table, these motions being imparted by handwheels, or by power feeds acting upon feed screws through bevel gears. The Eli Whitney expedient of the tilting shaft is made use of in this machine to throw bevel gears in or out of mesh. The power feed mechanism is driven from the spindle, five different speeds being obtained by the use of cone pulleys.

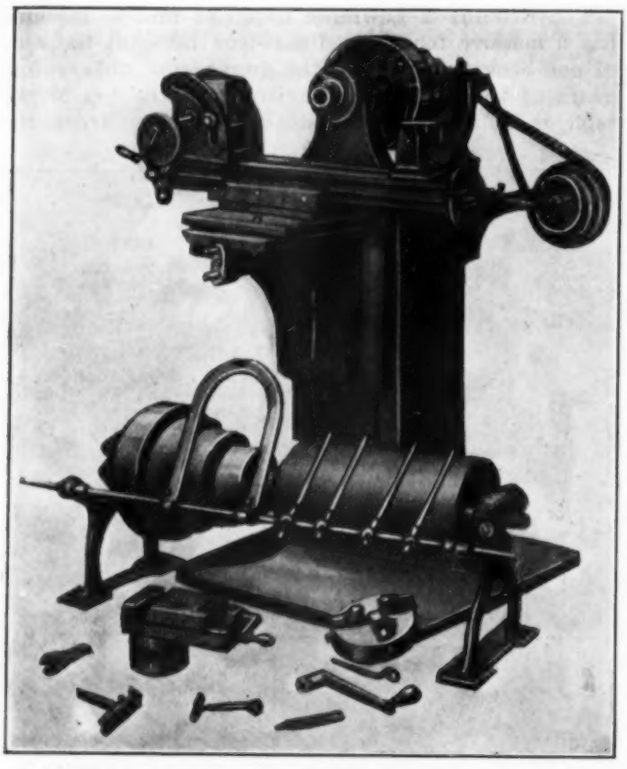


*Fig. 89—Joseph R. Brown's original universal milling machine*
(From the *Scientific American*, Dec. 27, 1862)

The Royal Small Arms Commission said in their report: "There is yet another and more expensive class of milling machine termed universal, from its capability of being twisted about to suit any purpose, or cut in any direction or form." The commissioners purchased

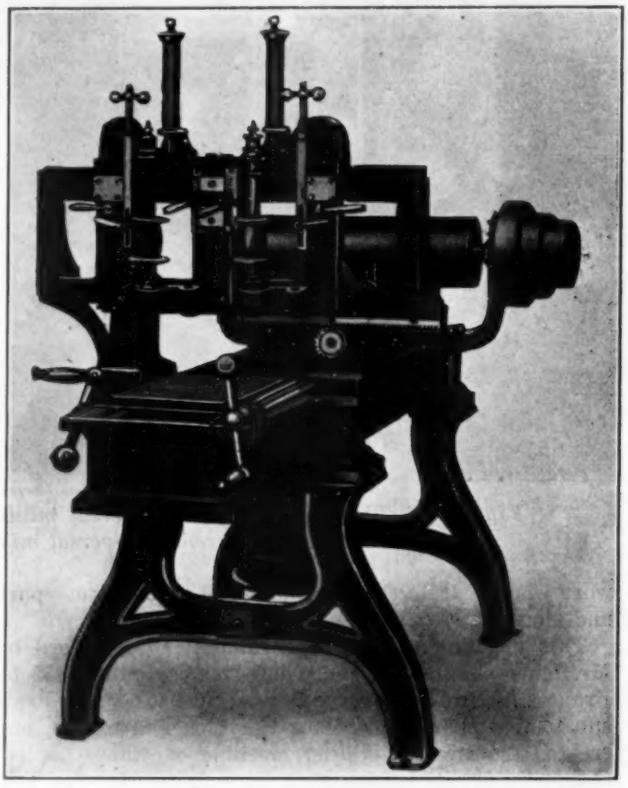
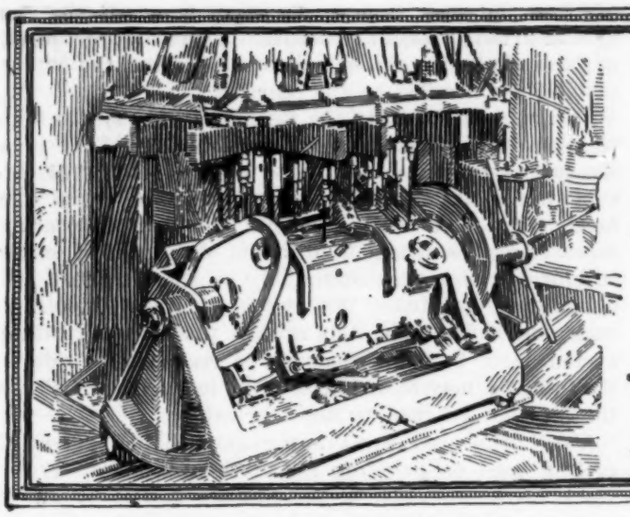


*Fig. 90—Robbins & Lawrence edging machine*
(From the Census Report of 1880)

eight of these machines from Robbins & Lawrence for the Enfield Armory in 1854, paying $850 each for them. It is a peculiar circumstance that in 1879 the *Scientific American* published an illustrated article highly praising some milling machines made in England, which were, in fact, exact copies of the Universal machines sent to the Enfield Armory from Windsor, Vt., in 1854.

The photographs and information regarding the operation of the ancient Robbins & Lawrence universal milling machines were obtained through the courtesy of the Lamson & Goodnow Manufacturing Co., Shelburne Falls, Mass., where several of them are in use.

The Robbins & Lawrence edging or profiling machine shown in Fig. 90 was one of the earliest machines of its type, and was the joint product of Mr. Lawrence and Mr. Howe, having been designed by Mr. Howe in 1848 to take the place of the filing jigs used up to that time at Windsor. This machine had straight slides, two vertical spindles, and double gearing for the feed motions, one set of gears being half a tooth forward to take up back lash and insure smoothness of action.



# Tool Engineering

By
*Albert A. Dowd and Frank W. Curtis*
*President and Chief Engineer*
*Dowd Engineering Company, New York City*

**Conclusion of work on cutting lubricants—Flood lubrication of heavy cuts—Coolants for broaching and grinding operations—Proper application of the lubricant**

AS IN thread cutting, so also in broaching, the application of cutting lubricants is more for the purpose of lubrication than for the cooling action. Broaches are pulled through the work slowly and the heat generated is not as great as on some other kinds of cutting tools. There are several important points, however, in the lubrication of broaches, and although these points apply more strictly to the machine operator than to the tool engineer, it seems advisable to mention them briefly.

In the example shown at *A* in Fig. 573, the work to be broached is round; and if the lubricant is applied through the pipe *B* to the broach *C* in the manner indicated, only a small amount of the oil will be carried into the hole and, as a consequence, the lubrication will not be throughly good. If it is found that a smooth cut is not obtained, a heavier oil may help somewhat, or a thin vaseline or grease can be applied to the broach with a brush as required. It will help the matter somewhat if the lubricant can be applied in the direction indicated by the arrow *D*, although even then the greater portion of it will not enter the hole when a round broach is used.

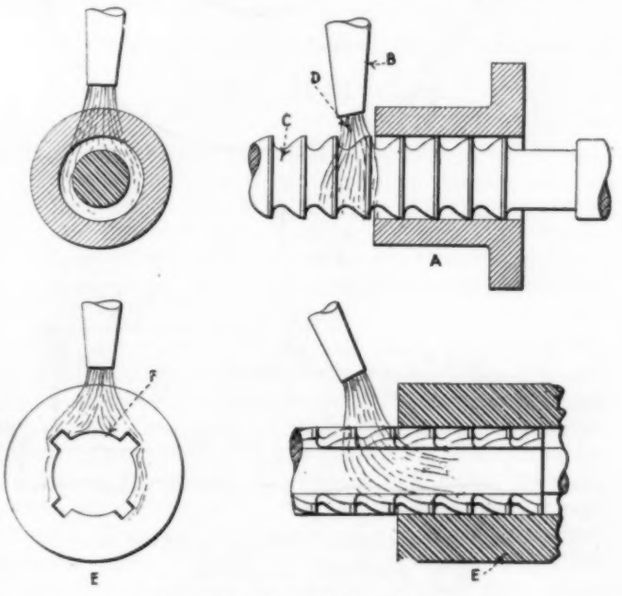



*Fig. 573—Broach lubrication*

In making fixtures for work which requires location from holes in a flange or from some other previously machined portion, if there are several keyways to be cut as shown in the example *E*, it is of great importance to locate the work so that the broach will be in the position shown in order that the lubricant will be carried along on the portion *F*, instead of falling off as it would if the teeth were placed in a vertical position. Little matters like these are really of a great deal of importance, and their neglect may prove costly to the manufacturer, and at the same time seriously injure the tool engineer's reputation.

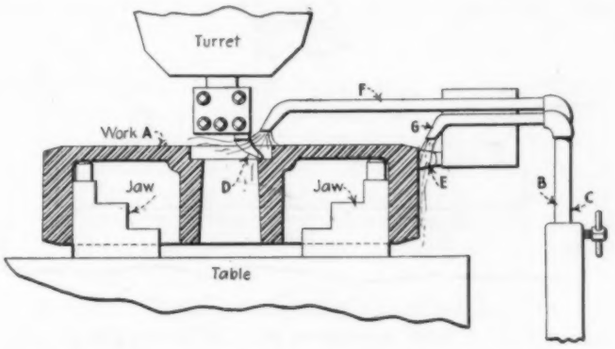



*Fig. 574—Lubricating system applied to vertical turret lathe*

We have previously mentioned the necessity for an ample flow of cooling compound on work which requires heavy cutting. Machines designed for this class of work should always be provided with an effective system for flood lubrication, for not only does such provision cool the tool and lubricate the work, but it is also of great assistance in washing away the chips which might otherwise accumulate and become troublesome. The production obtained from machine tools on which proper provision for copious lubrication has been incorporated

For the authors' forthcoming book. All rights reserved.

in the design, is far in excess of that obtained from other machines which are not so well equipped.

It is an important matter to arrange the piping on machine tools so that there are several orifices through which the compound can be forced under pressure. The piping must be adjustable in all directions to take care of different heights, shoulders or diameters, as the case may require. An excellent example of the application of flood lubrication to a machine tool is shown in Fig. 574, and the type of machine indicated is a vertical turret lathe.

The machine has a heavy sheet metal guard surrounding the table so as to prevent lubricant from being

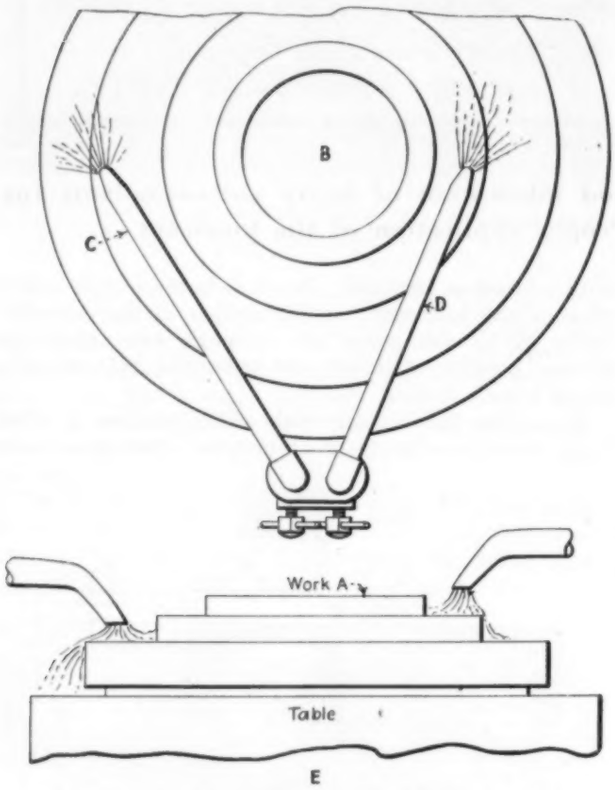



*Fig. 575—Diagram of vertical boring mill lubrication system*

thrown all over the floor of the factory. At one side and conveniently located in relation to the operator, is a standpipe containing two sliding tubes *B* and *C*, which can be adjusted vertically to suit the height of the work which is to be machined. The work shown at *A* is suitably held on the chuck jaws indicated, and the tool *D* is being used to cut the recess in the center hole while tool *E* is turning the outside of the work. The pipes *F* and *G* can be swung into such positions that they will discharge a good supply of lubricating compound on the work at the proper points.

The lubricant flows over the work and carries the chips away with it, due to the volume and force of the stream. The chips and oil fall down inside the guard and the oil drains through and goes back to the pump, becoming somewhat cooled on the way, from whence it is pumped over the work again repeatedly. In extreme cases where deep holes and undercut shoulders are to be machined, flexible connections can be applied to boring bars or other tools in similar fashion to those which have previously been shown. In the majority of cases, however, the supply is so generous that no special arrangements are needed. There are, of course, suitable shut-off cocks in each spout so that the supply is readily controlled by the operator.

In order to illustrate the flexibility of a system like this we show the diagram in Fig. 575. This is a similar type of machine to that shown in Fig. 574, except that it has two heads instead of a turret and side head. The plan view *B* shows the two lubricating pipes *C* and *D* swung in different directions in order to lubricate the work thoroughly on the shoulders and diameters indicated. With a ram carrying tools at each side of the table, it is evident that the lubricating system must be flexible enough to reach either side of the table, as may be required. The lower view *E* shows the portions reached by the lubricant.

Very little need be said in regard to the system of cooling used on grinding machines of different types, yet it seems advisable to mention the matter briefly in order to cover the general subject of lubrication as fully as possible. In grinding we have a point to consider which has not yet been mentioned, and this point is the change in sizes which occur when a piece of work is heated. Of course, all work when quite warm is

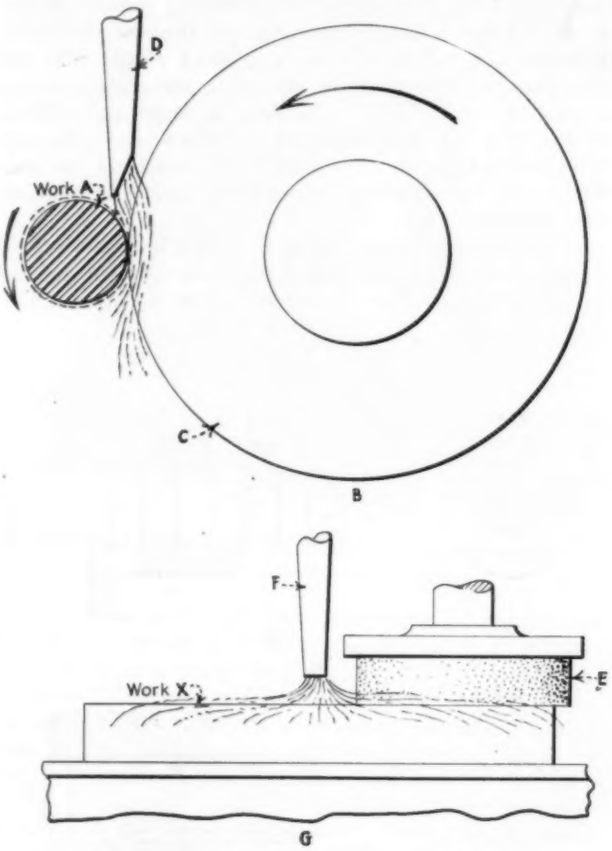



*Fig. 576—Cooling systems applied to grinding operations*

somewhat larger than when it has cooled to a normal temperature. In machining operations, the heating of the material is not so great as when grinding, nor is the accuracy required usually so great. As a consequence, we have not mentioned this point previously because it is of minor importance in ordinary production work.

Gages used for machining operations have much greater tolerances than those required in grinding operations, for in the final finishing of many parts by grinding the accuracy is of extreme importance. Therefore the cooling solution (usually water) applied to the work in grinding serves an important purpose by keeping the work cool so that it can be measured accurately during the process. Another function of the water application is to insure that the abrasive dust does not fly all over the room and get into the bearings of the machine tools. Still another reason is that the application of water seems to make the abrasive cut more satisfactorily. Any gain in production is, of course, worth while.

In Fig. 576 the diagram at *B* shows a piece of cylindrical work *A* which is being ground on an ordinary type of cylindrical grinding machine. Both work *A* and grinding wheel *C* revolve in the direction indicated by the arrows. A large spout *D* is so placed that it discharges a copious supply of water directly between the work and wheel. A great portion of the water flows over the work, thus tending to keep it cool during the process. The spout is adjustable so that it can be set in the different positions required.

In the diagram shown at *G* a surface grinding operation is represented. The work *X* is held on a magnetic table, and the water supply comes through the spout *F* and impinges on the metal directly in front of the grinding wheel *E*. The relation of the wheel and spout remain the same after they have once been set, and the water flows in a wide stream over the work and under the wheel as indicated.

Since the function of the cooling system has been explained for practically all types of machine tools, the tool engineer should now have a very good idea of its importance, so that when a problem a little out of the ordinary is encountered he should be well fitted to handle it efficiently.

## *Book Reviews*

**Statistical Abstract of the United States.** Published by the Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, D. C., 755 five and three-quarter by nine inch pages. Copies can be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 75 cents.

This book contains tables and data on the following subjects: Area, Climatic Conditions and Position, National Parks and Reservations; Public Lands, Irrigation and Drainage, Population, Vital Statistics, Immigration and Passenger Movement, Education and Vocational Rehabilitation, Farms and Farm Property, Farm Animals and Animal Products, Farm Crops, Forests, Fisheries, Minerals and Mineral Products, Manufacturers, Industrial Accidents and Fatalities, Commercial Failures, Occupations, Labor and Wages, Public Roads and Motor Vehicles, Postal Service, Telegraphs and Telephones, Railroad and Express Companies, Freight Rates and Internal Commerce, Merchant Marine and Shipping, Foreign Commerce, Commerce of Noncontiguous Territory, Consumption Estimates, Prices, Money and Banking, Obligations Due to United States Government, Revenues and Expenditures, Insurance and Fires, Public Debt, Wealth and Taxation, Army, Navy, Civil Service, Pensions, Statistical Record of the Progress of the United States, Commercial, Financial, and Other Statistics of the World.

This is a directory of all statistics gotten out by the United States.

**Technical Writing.** By T. A. Rickard, Contributing Editor, *Engineering and Mining Journal-Press*, Second edition, re-written and enlarged. 337 pp. 6x9. Published by John Wiley & Sons, Inc., New York. Price $2.

Perhaps our editorial and teaching experience was responsible for the sympathy with which we read Mr. Rickard's criticisms of technical writing. At any rate we enjoyed it even though the author seemed a little overcaustic at times.

There is no doubt that one of the engineer's weaknesses is inability to express himself so that his meaning cannot be misunderstood. To a certain extent his education is responsible because it fails to devote sufficient time to the study of English. As a consequence the technical man who aspires to the highest positions in his own profession or to a place in the business or political world must make up for the deficiencies in his early training.

Mr. Rickard's book will be of practical assistance to any engineer. Not only are general principles clearly expressed but small details as well. We have no hesitation in recommending it as a useful and necessary part of the engineer's library. If any further evidence of our approval of this book is necessary it will be sufficient to say that every editor on the *American Machinist* staff is required to read it.

**Foreign Commerce and Navigation of the United States for the Calendar Year 1922.** Published by the Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, D. C., 672 nine by eleven and one-half inch pages. Copies can be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price $1.50.

This book contains summary tables of exports and imports classified by nature of article, country and value; tonnage of vessels entered and cleared; and a vast amount of other statistical data regarding the foreign commerce of the United States.

To those whose minds run to statistics and their comparison, this book will be of great interest.

**Hendricks Commercial Register of the United States.** Published by S. E. Hendricks Co., Inc., 70 Fifth Avenue, New York. 2,402 eight by eleven and one-quarter inch pages. Price $15.

The thirty-second annual edition of this book has just made its appearance and will be welcomed as an old friend by those who wish to buy or sell anything from a needle to an anchor.

The book is a veritable compendium of information as to the makers of all sorts of articles, and is invaluable to all who have to do with buying and selling. A copy should be on the desk of every purchasing agent or official responsible for knowing by whom goods of all kinds are made.

The book is thoroughly indexed, and, at the back, 223 pages are devoted to trade names, and 419 pages to an alphabetical list of manufacturers.

# Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

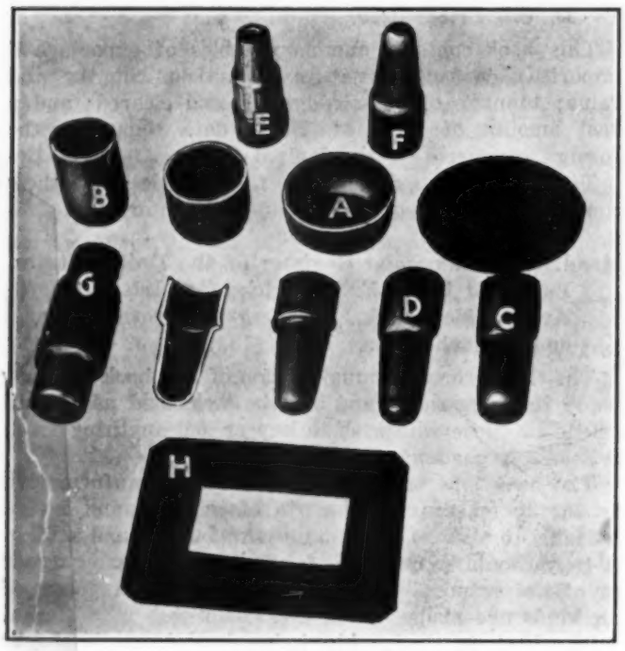
## Drawing a Shell to Accurate Size

BY AMOS FERBER

"Go" and "no-go" gages, establishing a very arbitrary and often a very narrow limit to the amount of variation from standard sizes that can be tolerated in a given product, are recognized factors in the routine of quantity production from automatics, milling, drilling, grinding and other production machines, but to find such gages in the press room is a little less usual. There are, however, many parts that come from the press, particularly the drawing press, practically finished, and the limits established may be quite as close as in the machine shop.

One such part, made by the Worcester Pressed Steel Co., Worcester, Mass., is shown in the accompanying illustration. The material is 0.079 in. steel, and the shell is completed in eight operations, not including three annealings to which the shells are subjected during the process. Four of the pieces shown in the picture are gages to which the various shells must conform, and one of the four is a true limit gage with an established tolerance of 0.001 in. plus or minus.

The first operation produces the cup at *A*, cutting the 3$\frac{11}{16}$-in. diameter blank and drawing the cup in one operation. Two complete redrawing operations follow, reducing the diameter of the shell and increasing its length to that shown at *B*, and a third redraw, in which the shell is passed part way through the die and pushed back by a knock-out, leaves the shoulder as at *C*. From this point two "necking" operations are required to bring the shell into the shape of the adjacent sample.




*Evolution of the shell*

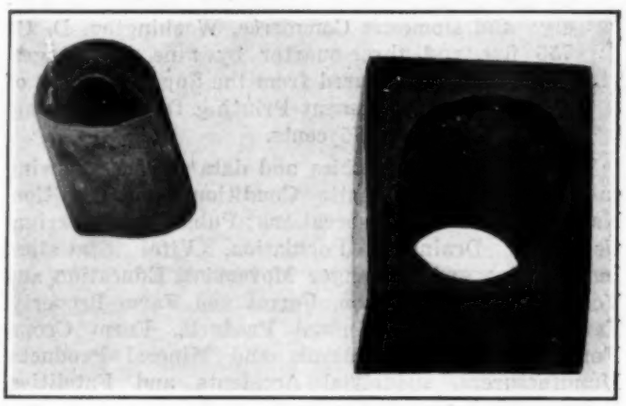
The open end is then trimmed and the next operation puts the bead on the shell by the upsetting method, in which pressure is applied endwise by a pair of formed dies that completely enclose the shell and limit the amount of flowage that can take place in a radial direction. The circular shape of the shell and the thickness of the metal can be relied upon to prevent buckling inward, and as there is no other escape possible, the metal must fill the dies and conform to their shape.

As the success of the operation depends upon having the exact amount of metal in shell *D* to fill the beading dies and no more, it follows that the shapes and sizes of the preceding shells must be known with accuracy. For this purpose the plugs *E* and *F* are provided. Gages *G* and *H* are for the finished piece; the first being the limit gage for the internal diameter of the opening and the latter to gage the overall length and the diameter of the bead.

## Peculiar Wear of Wood and Brass Bearings

BY FRANK C. HUDSON

Wooden bearings were common in olden days for line shafts and the like, and they frequently had a length of life that was truly remarkable. The bearing shown herewith is comparatively small, the shaft being a $\frac{11}{16}$-in. brass rod which oscillated only a small portion of a revolution in the bearing. The interesting thing is not so much the amount of wear but the way in which the wear took place.



*Unusual wear of brass shaft*

As shown in the illustration, the lower side of the shaft which took the load, wore to a much larger ra-

dius than the original. But the wear, both on the shaft and the bearing, is so irregular as to attract attention. The various surfaces or facets, if they can be so called, are very similar on the brass and in the wood. They are somewhat deeper in the wood, as might be expected, but they are very pronounced on the brass.

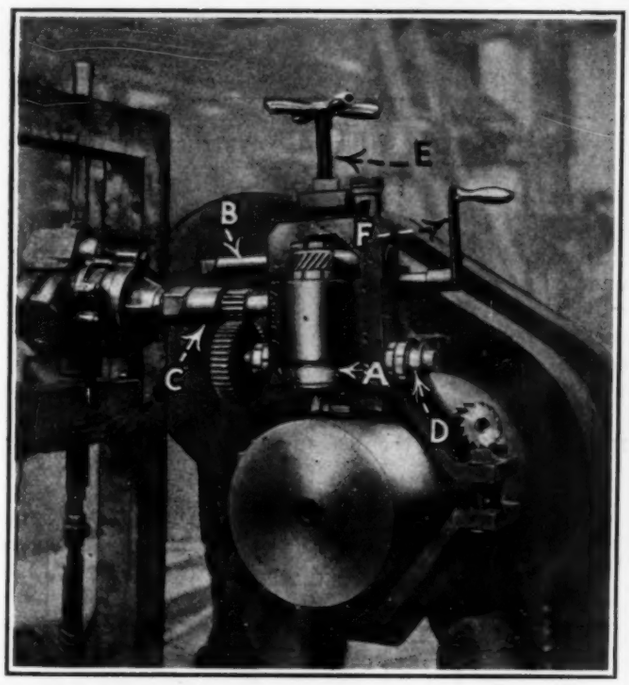
The wear of the brass is doubtless due to the wood acting as a lap, due to the collection of dust and grit which found its way into the bearing. I don't know how long this bearing had been in use in the wood working shop where I found it, but it had done service for so many years that the whole machine ought to have been pensioned instead of repaired.

## Portable Keyseating Machine

BY HERBERT F. CRAWFORD

The cutting of keyways in large crankshafts and similar places frequently presents quite a problem, and numerous special devices have been built for this purpose. The accompanying illustration shows a portable keyway milling-machine built and used by the Llewellyn Iron Works, Los Angeles, Calif., on some very large shafts.

The machine is clamped to the shaft in the usual manner, and the ends of the keyway are first milled,




*Double spindle keyseater for large shafts*

using the vertical cutter shown. It is customary to begin with a ¾-in. flat-ended drill, and sink it to the proper depth at each end of the keyway. Then, a hollow end-mill, from 2½ to 3 in. in diameter, according to the width of the keyway, replaces the ¾-in. flat ended drill, and the ends of the keyway are cut to the proper width and depth.

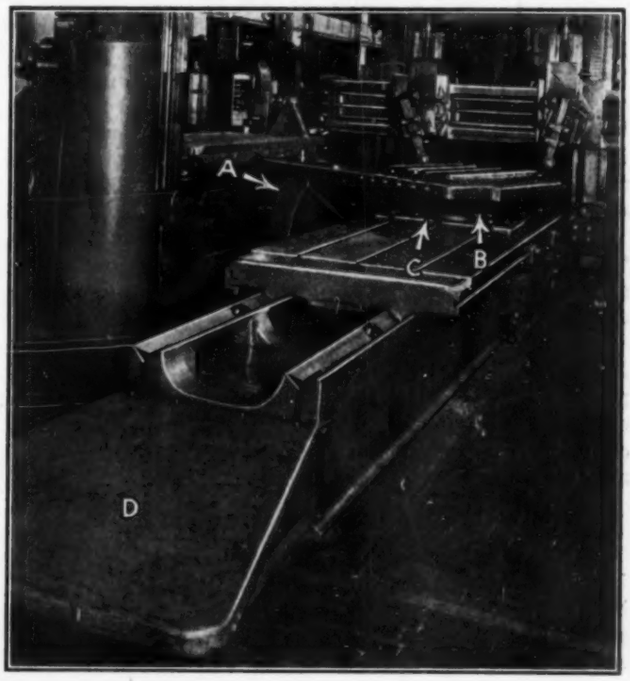
The vertical spindle *A*, used in milling the ends of the keyway is driven by the shaft *B* through the worm gearing shown. The lower horizontal spindle, which carries a milling cutter at *D*, is driven from the shaft *C* through the gears shown and has lock nuts at each end to take up any end play that might develop by use.

The milling cutter on the horizontal shaft is fed down to the proper depth by means of the screw *E*, while the whole milling head is fed lengthwise of the shaft by means of the crank handle *F*, operating through suitable reduction gearing. The slide for traversing the milling head can be seen just behind the horizontal spindle.

## Radius Planing on Turbine Work

BY CLIFFORD H. FRENCH

The illustration shows a very substantial radius planing device mounted on a Gray planer and used in the Rouge plant of the Ford Motor Co., in planing to a radius some segments used in connection with the building of the large steam turbines for the new Ford power plant. The outer end of the work-carrying




*Planer with radius cutting fixture*

fixture is pivoted to a fulcrum pin in the stationary bracket *A*, while the inner part is mounted on the slide *B*, which is free to revolve on the circular base *C*. It will readily be seen that as the planer table travels, the fixture being held by the fulcrum pin must both revolve and slide, the motion being that of an arc, the radius of which is equal to the center distance between the circular base and the fulcrum pin. It will be noted that two tools are at work, one on the inner and the other on the outer radius.

A safety feature of this installation is the heavy sheet metal guard *D* which projects from the end of the planer bed for a sufficient distance to prevent anyone being struck by the planer table, unless they sit or stand on the guard. The guard is fastened to the bed near the top and supported by horizontal braces running from the outer corners to the bottom of the bed. This makes a very neat, and at the same time effective guard for protecting passersby from the overtravel of the planer bed.

## A Boring Job Without a Boring Mill

By Anton Fancher

Contemplating the machinery with which the modern machine shop is usually equipped, I sometimes wonder what the machinist or toolmaker whose apprenticeship has been served amid such surroundings would do if he were suddenly called upon to solve some of the mechanical problems with which the shopman of forty years ago was often confronted.

The lathe, planer, and drill press were then the standard items of machine equipment; supplemented with a forge, a grindstone, possibly an "emery wheel" and a few odds and ends of miscellaneous junk.

I well remember a job that came into the little shop in France where I served my own apprenticeship some thirty-odd years ago; a job that could now be set up in a modern boring mill and completed without question of accuracy, and probably in one setting. It was a casting somewhat resembling the headstock of a large lathe but in which were incorporated brackets, or bosses, for two shafts parallel to the main spindle, as well as a fourth shaft at a right angle thereto. The holes for the bushings in which the shafts were to take their bearings were cored in the casting, but the only machine in the shop capable of finishing the holes was an ordinary drill press.

I indulged in a deal of speculation as to how the "old man" would handle that seemingly impossible job, and when he called upon me to assist him in carrying out the work, I was delighted with the opportunity.

One piece of our equipment was a floor plate of cast iron, fitted with bolt-holes and T-slots very like the platen of a large planer. The casting was brought to one of these plates, an assortment of boring bars, cutters, clamps, blocking and other paraphernalia assembled, and we set to work.

### How the Job Was Set Up

The casting was secured to the floor plate, and boring bars were passed through the cored holes. These bars were supported in V-blocks placed upon blocking pieces, and were carefully leveled up and brought into alignment with each other; surface-gages, squares, trams, and distance pieces with pointed ends being used to test the alignment. Before the bars were finally clamped, heavy coatings of smoke were applied to them, by means of a candle, at the places where they passed through the cored holes.

The next step was to close the ends of the cored holes by pieces of wood cut to fit tightly around the bars, and luted with putty, as if for babbitting. Molten sulphur was poured into the molds thus formed. When the sulphur had cooled, the clamps and blocking were removed and the bars loosened in their sulphur bearings by tapping and twisting them; an operation not difficult of accomplishment because of the coatings of smoke that had been applied.

The job was now removed to a large drill press, and set up by bolting it to an angle plate with the three bars in vertical plane, and one of them as nearly as possible in alignment with the machine spindle. A flexible coupling attached this bar to the drill-press spindle.

A cutter long enough to remove all the sulphur and as much of the iron as was desirable in one cut, was used. As the sulphur offered little resistance to the cutter, the apparently heavy cut was quite practicable. All of the chips, however, had to come out at the top of the hole.

Before the cutter broke through the hole, and while a quarter or half-inch of the length of the sulphur bushing still remained, the operation was stopped, all the chips carefully blown out of the hole and a bronze bushing, reamed to a running fit on the bar and turned on the outer diameter to a light driving fit in the newly bored hole, was pushed in to support the boring bar, in place of the sulphur bushing. Sufficient space was left between the cutter and the lower end of the bronze to accommodate the chips that would be produced in boring the remainder of the length of the hole.

The same method was repeated upon each bearing, leaving the casting with nicely bored holes for the shafts, all in proper relation and alignment.

In putting through the finishing cut, the bars were supported by the bronze bushing fitted in the preceding operation, followed by larger bushings having an outside diameter corresponding to the finished size of the hole. As the second cut was light and uniform it was necessary to enter the bushings but a short way in the bored holes, so we had little trouble in keeping the cutter clear of chips.

The first set of bronze bushing were of no further service on the job, though they were probably used on some later job. The second set became the permanent bearings of the machine, and their cost as tools was, therefore, negligible.

## Jigs for Use on Automatic Drilling Machines

By Ivan Svidlo

In the building of calculating machines there are a number of parts, such as shown at *Y* in Fig. 1, each of which is required to have a 0.10 in. hole drilled in the flange. As the distance *X*, of the hole from the center of the work, must be within very close limits, it was necessary for the drill jigs to function accurately.

The drilling was done on a two-spindle automatic machine, allowing the use of two jigs, one of which

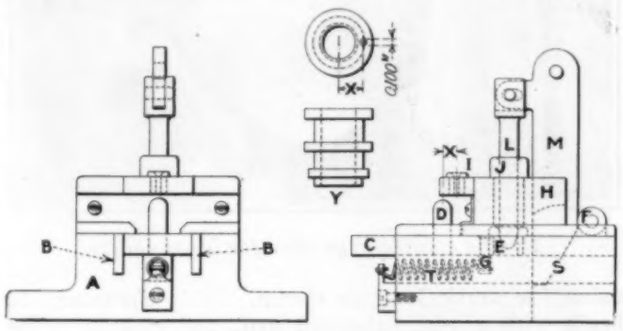



*Fig. 1—Details of the jigs*

could be loaded or unloaded while work in the other was being drilled. Since the drilling time was exceedingly short, it was necessary that loading and unloading the jigs be done very rapidly. The construction of the jigs, and their operation in conjunction with the drilling machine use are as follows, like parts being indicated by the same letters in both illustrations.

The cast-iron base *A*, has three slots milled in it, one

for the spring *T*, and two for the hardened and lapped plates *B*, the latter acting as guides for the slide *C*, which carries the stud *D* for locating the work, the bushing *E*, the roller *F*, and the spring stud *G*.

The bridge *H* is attached to the base *A*, and carries the bushings *I* and *J*. Plug *L* is connected to the cam *M*, and slides up and down in bushing *J*. Cam *M* is connected to the drilling machine through the lever *N*, which latter carries the grooved eccentric *O*, held in frictional contact with the constantly revolving roll *P*. Lever *N* has a direct connection with the weighted lever *R*, which keeps the eccentric in contact with the roll. As the eccentric is revolved by the roll, it transmits reciprocating motion to the lever *N* and, through the connections shown, to the machine spindle, the cam *M*, and the plug *L*. Upon downward movement of the cam *M*, the inclined face *S* strikes the roller *F*, and pulls slide *C* into the drilling position, at the same time carrying the work under the bushing *I* and bringing bushing *E* directly under bushing *J*. The movements are so timed that the slide *C* is locked by plug *L* before drilling starts.

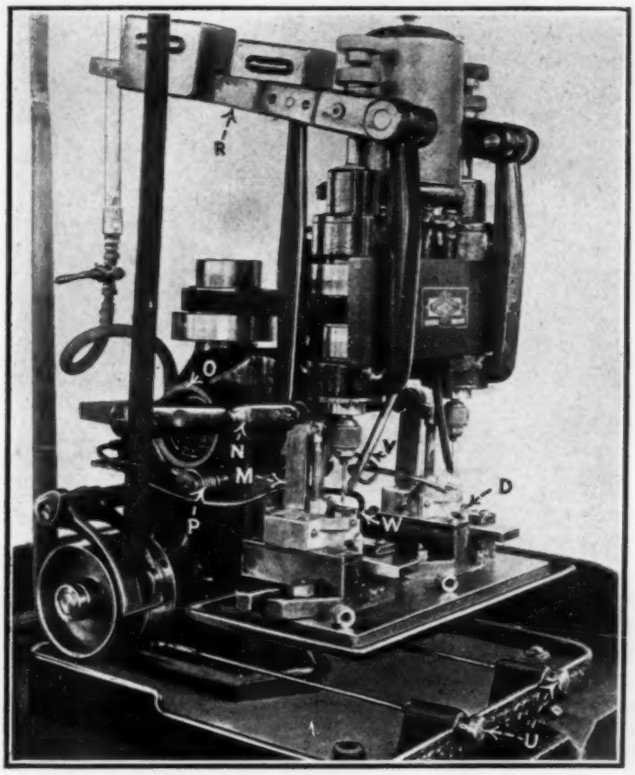



*Fig. 2—Jigs mounted on the automatic drill press*

On the upward movement, when the spindle and lever *N* reach their highest positions they are automatically locked, and plug *L* releases slide *C*, allowing it to be moved forward by the spring *T*. This motion brings the work from under the bridge *H* and permits its removal and the insertion of another piece.

The drilling operation proceeds as follows: The operator uses both hands; with the left hand she puts the work on stud *D* of first jig, and with the right hand she presses the button *U*, thus releasing the lever *N*, and the spindle of the machine to downward movement, when drilling begins. While this is being done with first spindle, the operator puts the work on stud *D* of the second jig with her left hand and presses the button *U* of the second jig, thus releasing lever *N* and the second spindle to downward movement. By this time the first spindle has finished the drilling, and the operator takes the drilled part off the stud of the first jig with her right hand, loads the jig with her left hand, and uses the right one again for pressing button *U*. The second spindle has by this time finished its drilling and the operator again performs the same cycle of movements while dirlling is being done in the first jig.

The tube *V* carries lubricating compound to the drill, and tube *W* carries compressed air, which automatically blows away chips after each drilling operation.

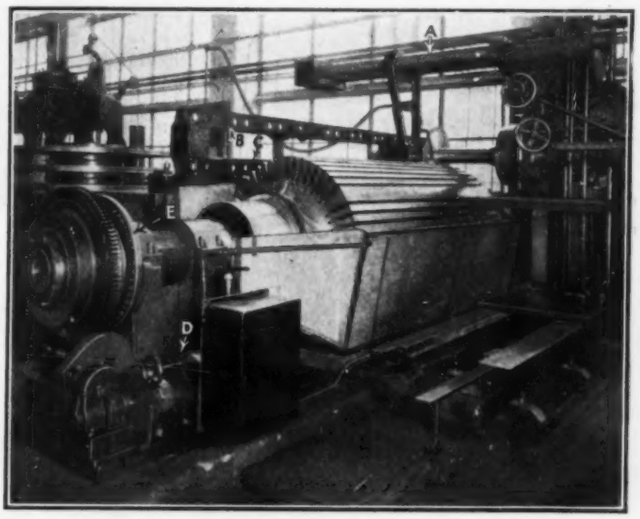
From this it can be seen that drilling is being done constantly with one or the other spindle, and it is this continuous drilling which is responsible for the increase in production to 750 pieces per hour, as against 171 pieces per hour when the job was done in the old way on the ordinary drill press.

## Slot Milling on a Boring Machine

By Francis C. Henry

One of the problems in making the rotor for the large turbo-generator sets for the new Ford power plant was the milling of the slots for the rotor coils. The size of the rotor required the use of a large machine, so a Niles floor-boring machine was rigged up to handle this work, as shown in the accompanying illustration.

The spindle has a bearing in the casting supported from the two overarms *A*, mounted on the machine column. The outer end of the spindle, beyond the overarm is supported in a substantial bearing arranged to slide between the rails *B* and *C* so as to hold it firmly as the column or upright is fed forward along the ways of the machine. The machine is thus converted into a very substantial milling machine having a large range, the outer support making it possible to take a good cut and feed.




*Milling slots in rotor for Ford power plant*

The indexing is done with the small motor *D*, which rotates the work by means of the worm gearing shown. Between the worm gear and the rotor is an index plate *E*, fitted with bushings which locate the work for each slot.

## A Short Arbor to Hold Thin Saws

By F. W. Bach

We were producing large quantities of cast-iron pistons ranging in diameter from 1½ to 3 in., and our method of removing the central boss at the solid end, which, until the final grinding operation, carries the center upon which the turning and grinding is done, is to saw it off in a hand milling machine.

Heretofore this sawing had been done with a metal slitting saw sufficiently large in diameter—not less than 6 in.—to be held between collars upon a standard milling machine arbor and allow the arbor to extend past the piston as the latter was held in the fixture. This method of holding, however, allowed the cutter to spring away from the work, especially after the corners of the teeth had become dulled, and resulted in a very unsatisfactory job.

To obviate this trouble I made the arbor as shown in Fig. 1, and used thereon a saw just large enough

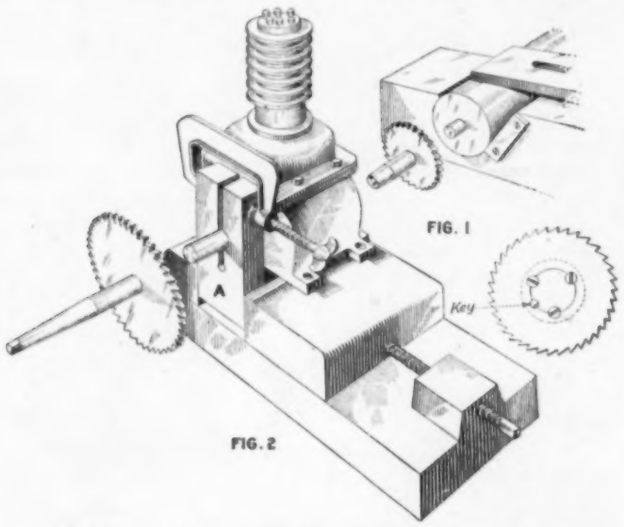



*Fig. 1—Method of attaching saw to arbor*
*Fig. 2—How the shafts were held to be sawed*

in diameter to do the work. The arbor was made with a short shoulder, just long enough to cover the thickness of the saw and come flush with its outer surface

Before the shoulder was turned on the arbor, three holes were laid off on the end and were drilled, tapped and countersunk for small flush-head machine screws. The holes were spaced equidistantly around a circle equal in diameter to the hole in the saw.

To provide space in the hardened saw for the countersunk heads of the screws, the places were marked off on the saw and ground in, as nearly as possible to the required shape, with a round-faced grinding wheel of small diameter. A 6-in. diameter wheel was the smallest we had, but as the screws are depended upon only to hold the saw to the arbor, this served the purpose very well. A key, driven into the arbor, furnished the resistance to the driving power.

This device served another purpose to great advantage at a time when we received an order for a number of our machines with the shaft ¾-in. shorter than standard. To fill the order would have necessitated building an equivalent number of machines to special order or else taking that number from stock, disassembling them, and cutting off the shafts in a lathe.

Instead, we took stock machines from the shelf, set them in the vise of the hand milling machine in the manner shown in Fig. 2, and sawed off the shafts with a metal slitting saw held upon the above described arbor. The spring clamp *A* was made to a thickness just equal to the required length of overhang of the shortened shafts, and with a hole at a distance from the lower edge that allowed the machines to set naturally upon the vise jaws.

The clamp was tightened up in the vise and not again disturbed during the operation. A machine would be set in place, as shown, with the shaft protruding through the hole in the spring clamp, a heavy C-clamp applied to close the jaws of the spring clamp upon the shaft, and the end of the shaft cut off with the saw, which was set to clear the face of the spring clamp by the thickness of a sheet of paper.

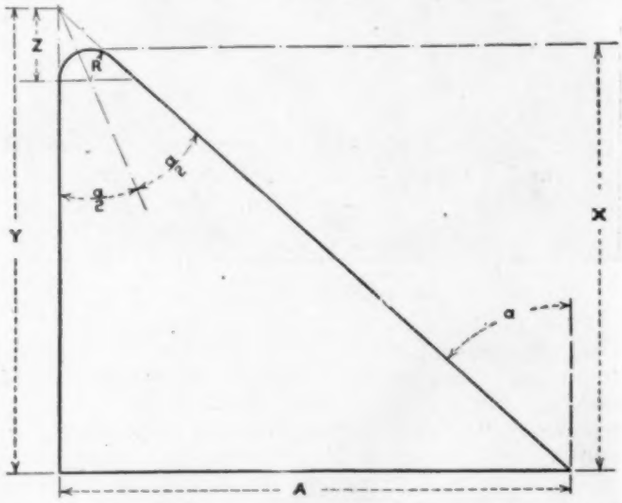
Unskilled labor could be employed on the job, as the thickness of the spring clamp insured that the shafts could not be cut too short.

## A Trig Problem Often Met—Discussion

By Mark A. Rumely

After reviewing Mr. Heller's problem on page 923, Vol. 59, of the *American Machinist*, it appears to the writer that the solution given is much more involved than is necessary. The problem is shown in the diagram herewith, the length *A*, the radius *R*, and the angle *a* being given.

The angle at the apex of the triangle is equal to angle *a*, and if a line is passed through the apex and




*Construction for finding gage dimensions*

the center of the circular arc, it will bisect the apex angle. It is apparent that $X = Y - Z + R$.

$$Y = \frac{A}{\tan a}$$

$$Z = \frac{R}{\tan \frac{a}{2}}$$

$$X = \frac{A}{\tan a} - \frac{R}{\tan 2} + R$$

This final expression for $X$ involves only the use of the data given in the statement of the problem and requires very little calculation. Using the numerical

values given in the original problem, $A = 1.5$, $R = 0.25$, and $a = 29$ deg.

$$X = \frac{1.5}{0.5543} - \frac{0.25}{0.2586} + 0.25 = 1.989371$$

This does not check exactly with Mr. Heller's result on account of a slight numerical error in his solution.

## Tap Clearance Tool for "Blind" Holes—Discussion

BY F. M. A'HEARN

The article under the title given above, by J. T. Towlson, on page 959, Vol. 59, of the *American Machinist*, describing a tool for cutting tap clearances in the bottoms of "blind" holes, reminds one of the story that was current a few years ago concerning a man who had perfected (?) a machine that would do the work of six men, although it required seven men to operate it.

The tool in itself will no doubt do what it is intended to do, but the practice of doing work in the manner described, appears to be rather questionable, for the following reasons:

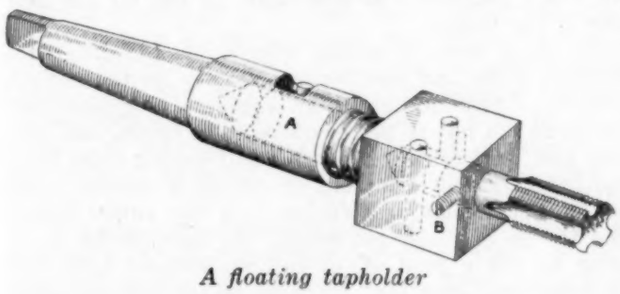
First, the enlargement of the hole at the bottom in the manner shown, weakens the section of the piece, Second, the use of the tool in cutting the clearance, involves an extra operation in the progress of the job. Third, suitable tapping equipment will reduce the tap breakage to a negligible point. Fourth it is a better practice to design parts in such a manner as to permit finishing with the minimum number of operations, and without the use of special tools, rather than to attempt to assemble two or more "wrongs" into one "right."

## A Floating Tapholder

BY W. F. SANDMANN

When using a multiple-head tapping machine on production work it is necessary to provide floating holders to drive the taps in order to avoid excessive breakage, for the reason that not all of the taps will begin cutting at the same time. The floating feature of the holders allows one tap to lag behind the others for a revolution or so before taking hold.

An easily made and inexpensive floating tapholder that has proved very satisfactory to us is shown in the




*A floating tapholder*

accompanying sketch. It consists of two main parts that are not difficult to produce, some short pieces of drill-rod, a headless setscrew, and a coil spring.

The holder *A* is made with a taper shank to fit the hole in the spindle of the machine, and the hole in the outer end is bored to a size that will be a free fit for the round shank of the collet *B*, in which the tap is held. Instead of broaching a square hole in the collet to drive the tap, the bore is made large enough to take the round part of the tap-shank and the driving is done by two cross pins of drill-rod located as shown.

A wide slot extends diametrically through the holder *A* and a cross pin, driven through the round shank of the collet when assembling, holds the two parts together and serves to drive the latter. Because of the extra width and length of the slot in proportion to the size of the driving pin the tap is given considerable latitude in both endwise and rotative movement. The headless setscrew serves to prevent the tap from dropping out of the collet.

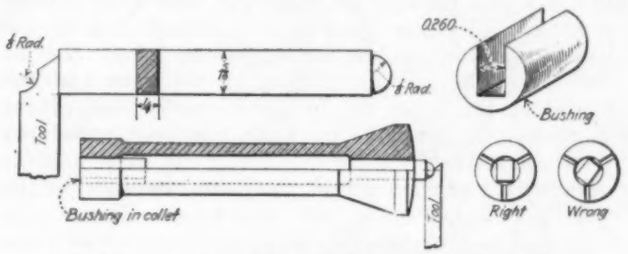
If the tap does not take hold at once, the advance movement of the machine head will compress the coil spring and increase the pressure until the tap does take hold. We rarely break a tap because of failure to engage before the limit of the float is reached.

## A Screw Machine Kink

BY H. J. GUSTAV KOPSCH

The little kink here described worked out so well that I feel justified in passing it along to readers of the *American Machinist*.

A lot of about 1,000 of the pieces shown in the sketch was wanted with as little delay and expense as possible. The stock was cold-rolled steel of $\frac{7}{16}$x$\frac{1}{2}$-in. rectangular section. A special collet of this size and shape would have been expensive to make and would have delayed the job in the making, but I found upon trial that,




*Holding rectangular stock in a round collet*

owing to the slightly rounded corners to be found upon stock of this kind, it could be gripped in a regular $\frac{3}{8}$-in. collet very nicely.

The application of the cutting tool would, however, cause the stock to slip, and a corner would then fetch up in one of the slots of the collet, in which position it would not be held very tightly nor would it run true. I therefore made the little slotted bushing shown to the right in the sketch, pressed it firmly into the rear end of the collet, where it did not interfere in the least with the opening and closing of the latter, and was ready to proceed.

The work was done in a small Warner & Swasey turret lathe, only the cross-slide being used. At every forward movement of the slide the tool would cut off a finished piece and make the round on the end of the bar, ready to be cut off after the next advance of the stock.

The bushing was made with a slot from one side instead of with a rectangular hole, as it was easier to make it that way and it served the purpose quite as well. The dimensions of the slot included a liberal tolerance, so there would be no trouble in entering the stock.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
*Editors*

February 14, 1924

## *Two Great Post-War Figures Pass on to the Other Side*

WITHIN a few days two of the outstanding figures of the reconstruction period following the World War have gone to judgment. To some people it may not seem fitting to couple the names of Nikolai Lenine and Woodrow Wilson but we believe that history will accord both of them a prominent place for the impress they left on human progress.

Both men were idealists although their ideals differed widely. The American endeavored to impose upon three hard boiled European diplomats a program of world peace based upon ideals. His program was emasculated but he lived to see some of his bitterest opponents begin to appreciate the underlying worth of his plan.

The Russian, on the other hand, put his scheme of communistic government into complete operation with the enthusiastic aid of his loyal followers. To accomplish his end he adopted measures that were hardly compatible with his theories and brought about the almost complete annihilation of his enemies. But he lived to see the complete failure of his hopes and had to swallow the bitter pill of partial restoration of the old capitalistic methods by what has been called the "economic retreat."

There is a sermon in the reception accorded to the world policies of these two statesmen. The radical socialistic plan of the one met immediate favor from the masses and rode to quick success. Within a few months its fatal defects were obvious and its inevitable downfall was recognized. The thoughtful attempt of the other to work on a basis of improvement of existing conditions that have stood the test of time met with early discouragement but is growing on men as they understand it better and realize more fully the results of trying to get along on the old basis.

## *The Appropriation for Aviation*

NO ONE CAN find fault with the spirit of economy in government expenditures. Both great parties are vieing with each other in making gestures which ought to result in some real savings. But, just as in the management of any large industry, it is easily possible to save money which could be spent to good advantage.

The appropriation for aviation is a case in point. If this were simply a case of developing a new mode of warfare, we might all be pardoned for desiring a small appropriation. But instead of being confined to military or naval operations, it is the only activity of either branch of the service which has to do with commercial problems. The development of air transportation is as vital as was the telegraph or the radio and it should be encouraged by every legitimate means.

When airplanes can be built in quantity as is the case with automobiles, the cost will be but a fraction of the price which it is now necessary to charge and much of the present cost is due to the intermittent orders which the airplane builders receive, as well as to the fact that the changes which must be made in any new product, necessitate new tools and fixtures for each lot.

There are several thoroughly reliable builders of planes who secure orders at irregular and infrequent intervals. This keeps the cost of overhead very high as in any other business. One of the bad features, however, is the difficulty of securing workers who are experienced in this class of work. The uncertainty of future orders makes it practically impossible to maintain even a skeleton organization outside of the engineering and executive force.

The appropriation for aviation should be ample to allow continued operation of a few of the best factories, which will do more for the substantial development of the industry than anything else.

## *Rolling Your Own*

EVERY once in a while we run across a shop where the management has taken the advice of the cowboy and tries to "roll his own" when it comes to making many of the small tools such as milling cutters and reamers. Some few are even bitten by the bug of making their own drills, but they are scarce.

After having visited a shop of this kind recently it was refreshing to find a works manager who had been through the mill—and reformed.

He said, "We had quite a spell of making our own milling cutters. Had a little run-in with a cutter maker and decided we'd roll our own. Kidded ourselves into believing we were saving money. One day we woke up and found we were not getting production out of our big, expensive milling machines. Worse than that, the cutters were actually costing us more money when we charged overhead and some other expenses which we'd forgotten, purposely or otherwise, to put on the cost side of the books.

"In these days of milling alloy steels the difference between profit and loss depends largely on the cutters you use. Fast milling is an engineering proposition and each job has to be considered separately. We not only quit making cutters but we quit buying them from the ordinary tool salesman or out of a catalog. We put our particular problem up to a live cutter maker and let his engineer get busy. We have plenty to do after we get a good set of cutters, without bothering to make 'em—especially when we've satisfied ourselves it doesn't pay."

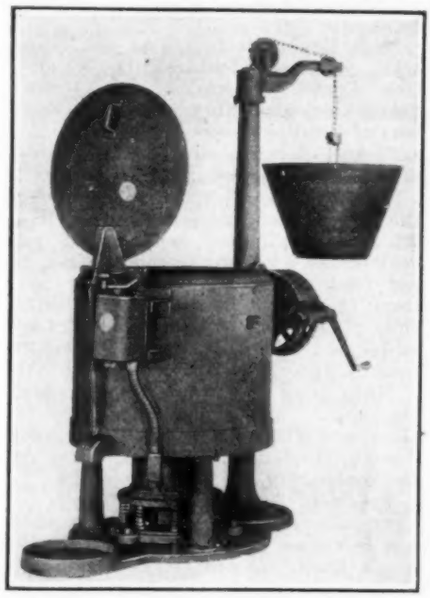
This is the experience of a very well known shop where production costs are low and where the *net* is looked after very closely. It is worth the careful consideration of all who are interested in real economy of operation. Every man to the trade he knows best.

# Shop Equipment News

## Curtis Motor-Driven Oil Extractor

The Curtis Machine Co., P. O. Box 44, Worcester, Mass., has recently placed on the market a machine of large capacity for extracting oil from chips, driven by a direct-connected motor, thus eliminating the necessity for belts and countershafts.

The rotating member of this machine is a single unit consisting of



*Curtis Motor-Driven Oil Extractor*

the supporting bearing, the motor and the central upright shaft, over which the chip basket is placed. The unit is not fastened to the machine in any way and may be lifted out entire without removing bolts or nuts. Its combined weight is 240 lb., without the load of the chip basket.

The supporting bearing consists of a rounded or partly hemispherical stud resting in a tapered socket, the design being intended to take up automatically any radial play that may be caused by wear. As this bearing does not revolve, but has only a slight rocking motion when the machine is in action, the wear is negligible.

A flange is bolted to the lower end of the motor cage and rests upon the circle of coil springs that may be seen in the illustration, but the springs do not normally bear any part of the weight of the rotating member or load. The weight is sustained by the step-bearing and it is the duty of the springs to prevent the rotating member from tipping sidewise when stationary and to act as a damper to the gyratory motion when the machine is running.

The motor cage is prevented from rotating by two ball-end studs that project downward from the underface of the flange and enter suitably shaped slots in the base of the step-bearing. Upon these studs, therefore, the duty of resisting the torque of the motor is imposed.

The rotor of the motor, to which is permanently fastened the vertical shaft over which the chip basket is placed, revolves in Timken radial and thrust bearings, housed in the motor cage. These are the only active bearings in the machine and are located where they are protected from dirt or foreign matter.

The chip basket has a capacity of two bushels, the weight of the load depending upon the material and nature of the chips.

A counterbalanced cover closes the open top of the containing case when the machine is running, and this cover is so interlocked with the motor controller that the motor cannot be started with the cover open, nor can the latter be opened with the machine running.

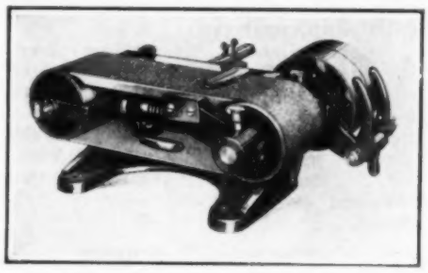
With the machine open, as shown in the illustration, the motor and its extended rotor stands in a vertical position with the flange of the motor cage resting upon the circle of springs. When the loaded basket is lowered into position, the unit will, if not then in exact balance, be tipped until the excess weight on one side is counterbalanced by the compression of the springs under the low side of the flange. The whole unit is thus a sort of spring balance, and the shaft may be restored to its vertical position by adding chips to the light side.

The machine is equipped with a G. E. motor, designed to give a high a starting torque and to withstand without heating the frequent startings and short cycles necessarily imposed by this class of machine. It is supplied for 220-, 440- or 550-volt, 60-cycle, alternating current, as desired. The controller is permanently mounted upon the machine casing in a position convenient to the operator. The floor space occupied by the machine is 2½x4½ ft., and the weight of the unit is approximately 1,300 pounds.

## Walls Abrasive Band Grinder

A recent addition to the line of abrasive band grinders marketed by the Walls Sales Corp., 96 Warren St., New York, N. Y., consists of the "Simplex A" model, shown in the accompanying illustration.

This small grinder is fitted with tight and loose pulleys, and has an



*Walls Abrasive Band Grinder*

extra outboard bearing with a movable shifter fork to meet various belt angles. The work table is 10½x 5 in. and the abrasive band is 4 in. wide.

The bands may be quickly changed when the machine is in motion, and a variety of bands can be furnished in many grits to suit any finish required. The maximum power required is ½ hp., and the 5½-in. pulleys run at 1,100 r.p.m. The machine is especially adapted to finishing work on a variety of materials where a straight-grain finish is required. It is also useful for roughing and smoothing work.

# News of the Week

## Trade Association Discussion Brings Forth Many Opinions

### *Lumber men claim legality for statistic dissemination*

Trade associations may lawfully collect from individual members statistical data necessary to the compilation of general information, and the latter may be properly and lawfully as well as beneficially published by them, says Wilson Compton, secretary and manager of the National Lumber Manufacturers Association, in a letter to Hon. Stephen B. Davis, solicitor of the Department of Commerce.

This letter constitutes the first public statement on behalf of a national industrial association in interpretation of the requested informal opinion on the subject given to Secretary of Commerce Hoover by Attorney-General Daugherty and recently made public. This opinion has been variously interpreted, owing to apparently conflicting statements contained therein. Mr. Compton holds that the law and the Attorney-General's opinion are:

First: Trade associations may lawfully gather from members individual detailed information on production, orders, shipments, stocks and prices, but this individual detailed information may not be given to the public or distributed to members.

Second: General information showing the conditions of an industry and changes in supply of and demand for its products, such as the total production, shipments, stocks on hand and the average price or range of price, etc., may be compiled from the information obtained as above and may be published.

#### Interpreting Daugherty

It will be recalled that Mr. Hoover wrote to Mr. Daugherty to ask his opinion as to whether—in view of recent court decisions and decrees—trade associations could collect and publicly disseminate fundamental information in regard to their trades. There has been great diversity of opinion as to the meaning of the reply—some associations even taking the position that it means that the Attorney-General considers it unlawful for trade associations to collect and publish that general information in the absence of which business generally and the economic direction of the country's affairs will necessarily be without intelligent guidance.

Mr. Compton asserts in his letter to the Solicitor of the Department of Commerce, that no other conclusion than that stated makes it possible to reconcile the several statements in the Attorney-General's letter. "A natural, and if you please, I might say a common-sense interpretation of the Attorney-General's letter," he says, "is that the Attorney-General has plainly, although indirectly said, that the activity in question—the compilation and publication by trade associations, of current trade information—is not *per se* unlawful. For example, the Attorney-General says:

"'In my judgment the effect of general information as to the conditions of an industry, such as the total production, shipments, stock on hand, and average price or range of price, is entirely different from that resulting from each person engaged in an industry receiving directly or through a common medium reports which reveal to him the exact condition of the business of his competitors. When thus informed each one is invited and is naturally inclined to imitate the conduct of his most successful competitor; and the spread of comradeship created by the confidential exchange of information of this character necessarily prevents the free competition between them, which would otherwise prevail.'"

## Big Gains Shown in Group Insurance

The remarkable growth of group life insurance, which at the end of 1922 amounted to $1,800,000,000 and covered approximately 2,000,000 employees, is made the subject of a bulletin which has just been issued by the Insurance Department of the Chamber of Commerce of the United States.

The first group life contract, the bulletin points out, was issued as recently as 1910 "in an effort to bring employees and employer closer together in a human relationship way." Since then it has been extended to 2,000,000 employees from all types of commercial and industrial enterprise.

Group life insurance is defined in the bulletin as "insurance covering all or certain classes of the employees of an industry and provides in case of death or total disability while in the employ of a company, that a specified indemnity shall be paid the beneficiary."

"It has been estimated," the bulletin continues, "that approximately 30 per cent of the workers in industry carry no insurance. Entire financial collapse in many of these cases is co-incident with death. Approximately 30 per cent more, it is claimed, have not more than $500 of life insurance, while the average insurance in force for the remaining 40 per cent does not exceed $1,000."

The methods usually employed in taking out group insurance and of developing an interest in it on the part of employees are described at length in the bulletin. It is not held that group insurance is a panacea for labor turnover, but where all other things are equal it is regarded as playing an important part.

## Annual Banquet of Providence Engineers

New England's future as an industrial center is doubtful, Dr. George Otis Smith, director of the United States Geological Survey, told the members of the Providence Engineering Society and affiliated bodies at their eighth annual banquet held recently.

"It is a serious question how long the narrow seaboard zone between Boston and Washington, with only 2 per cent of the area of the country but 22 per cent of its population, will continue to deserve the name of finishing shop of the nation, using a third of its power and producing 40 per cent of its manufactures," he said.

More than 600 engineers attended the dinner and were commended by Governor William S. Flynn and Mayor Joseph H. Gainer for their work in the community.

President Ralph W. Eaton of the society announced that its membership has increased to 1,250. In addition to music from two orchestras and group singing, the guests were entertained by "stunts" by men attached to the Providence Gas Co. and Narragansett Electric Light Co. Frederick W. Bliss, first vice-president, was toastmaster.

More unbiased counsel from men of business and science, and less partisanship will help the men responsible for the conduct of the Government to fulfill their vast responsibilities, Merle Thorpe, editor of *The Nation's Business*, told the assembled engineers.

### Auto Production Schedules

Interesting production figures of automotive plants in Detroit are as follows: The Ford company is building 8,000 cars a day; the Cadillac plant has increased to 110 cars a day and will probably go to 125 a day within a short time; the Essex plant has a schedule of 500 cars a day which will go into effect on March 1, it is rumored; the Jewett-Paige plant are working toward a schedule of 300 a day, it is understood; the Maxwell plant expects to be up to 350 a day shortly; and the Rickenbacker plant has also increased its production.

# Industrial Preparedness Is Planned by New York Engineers

## *Judge Gary presides at enthusiastic meeting*

Some 800 members of the New York Sections of the Founder Engineering Society, the Society of Automotive Engineers, and the Army Ordnance Association and their guests, dined at the Hotel Commodore on Feb. 5, in the interest of industrial mobilization. Judge Elbert H. Gary presided, and the speakers were Col. Dwight F. Davis, assistant secretary of War, Gen. J. J. Carty, vice-president of the American Telephone & Telegraph Co., and Col. James L. Walsh, Ordnance Officers' Reserve Corps and Ordnance Chief of the New York district. In the foyer were a number of exhibits of the latest types of ordnance material, from radio apparatus to aerial bombs.

Judge Gary in his opening remarks laid stress on the need for industrial preparedness as an essential in case of war and as the best insurance against war. As an instance of the willingness of industry to co-operate in the War Department plans, he read a resolution adopted at the recent meeting of the American Iron and Steel Institute urging its members to co-operate with the Government in laying plans for industrial mobilization.

### Secretary Davis Speaks

Secretary Davis, who, by virtue of his position, is Chief of Procurement and Director of Industrial Mobilization, outlined the scheme in much the same form as in the exclusive article written by him for the *American Machinist* and published several weeks ago. He emphasized the fact that modern warfare enlists not only the armed forces, but the whole fabric of the country. He said that the present plan would have to be greatly modified if it were intended to put us on the war footing thought necessary by many European powers. He aroused enthusiasm by stating vigorously that in the next war there would be no slackers and no profiteers, if the Government plans do not miscarry. Col. Davis announced that the American Institute of Mining and Metallurgical Engineers is studying the raw material situation, the American Railway Association is studying the transportation question, the American Telephone & Telegraph Co. is working on communication, and the American Iron and Steel Institute on steel. Mr. Bernard Baruch is giving freely of his advice on the formation of the superboards and other organizations needed in time of war. Col. Davis concluded by saying that our standing Army is the smallest proportionately of any in the world, and that some of its services have been reduced below the safety limit.

Gen. Carty, vice-president in charge of research, of the American Telephone & Telegraph Co., recalled the days before the war when he, as president of the American Institute of Electrical Engineers, was able to save valuable time for the Government by getting a start on the study of the communication problem before the actual outbreak of hostilities. He said that the Telephone company now is working with the Government to arrive at a uniform contract which will be fair to both parties and result in the least delays in time of war. He recommended that other industries follow the telephone people in trying to find substitutes or alternative materials for those which would be difficult of procurement if foreign supplies were cut off. He said that he believed that such studies would result in economies in peace times that would more than pay the cost of the effort.

Col. Walsh maintained that time is the prime essential of preparedness. Congress can appropriate billions if necessary and call millions of men to the colors, but it is impotent to legislate the needed time to get the war machine working smoothly.

### Ever-Changing Ordnance

The difficulties of the Ordnance Department were illustrated by reference to the changing styles of ordnance. The modern 75 mm. gun shoots twice as far as the French 75 of the early war days. The 155 mm. shoots five miles farther than its older counterpart. We now have 4,000-lb. aerial bombs, some of which have actually been dropped from airplanes, where but a short time ago 2,000-lb. bombs were the largest in existence. Automatic shoulder rifles bid fair to replace the Army Springfield.

What is most needed by the district ordnance chiefs at the present time is the co-operation of the engineers in their districts in getting information needed to complete the district mobilization plan. Col. Walsh suggested that it might be useful to assign to some of the younger members of an organization the problem of planning how to transform the plant to wartime production. He also suggested this as a possibility for thesis work of senior engineers in technical schools.

Gen. C. C. Williams, Chief of Ordnance, was called upon to speak extemporaneously, and congratulated the New York district on the success of the first attempt to arouse enthusiasm for industrial mobilization. The meeting closed by every man present standing in a rising vote at Judge Gary's call to indicate his desire for peace, even if it be necessary to fight for it.

# More Motor Trucks for the Pennsylvania

The Pennsylvania railroad has put into operation this week four more motor truck units, making a total of eleven units and twenty trucks in regular operation, displacing eleven local less-than-carload freight trains.

On Feb. 4, motor truck service was inaugurated on the Atlantic division, between Gloucester and Newfield, and between Wilmington and Perryville on the Maryland division. On Feb. 7 motor trucks began work between Arch St., Palmyra, and Bordentown, and between South Amboy and Bordentown, both on the Trenton division.

R. S. Hurd, special agent of the Pennsylvania railroad in charge of motor truck operation, says that studies are in progress for further installation of trucks and that the 602 miles of daily truck operation will soon be increased to 1,000 miles.

Store-door delivery of less-than-carload freight is the ultimate objective of the Pennsylvania railroad, according to R. C. Wright, general traffic manager.

# R. K. LeBlond Now Heads Niles-Bement-Pond

At the annual meeting of the Niles-Bement-Pond Co., R. K. LeBlond was elected chairman of the board of directors; J. K. Cullen was elected president; C. L. Cornell and S. G. Etherington, vice-presidents; J. B. Cornell, treasurer; C. S. Guthrie, secretary; and E. J. Edwards, Jr., assistant secretary and treasurer. The following were re-elected directors: J. K. Cullen, C. L. Cornell, J. B. Cornell, Henry Bertram, F. W. Gordon and S. G. Etherington. The following new directors were elected to fill vacancies: R. K. LeBlond, Gordon Rentshcler, Lucius Rossiter, Edward L. Leeds, Charles K. Seymour and George Warrington. The board declared the regular quarterly preferred dividend, payable Feb. 20 to holders of record Feb. 7.

# Car Loading Again Sets New High Record

A new high record for car loadings for the last week of January was established with the announcement that loadings for the week ended Jan. 26 were 891,326 cars, an increase of 21,862 over the same week of 1923, which was the previous high record. The total exceeded the same week in 1921 by 150,940.

Loadings of merchandise freight, generally taken as a criterion of business conditions throughout the country, showed an increase of 13,808 cars compared with the same week last year. Miscellaneous freight amounted to 283,250 cars, a decrease of 5,480 cars from the week before, and 3,020 cars under the corresponding week in 1923. Compared with the corresponding week in 1922, it was an increase of 74,861 cars.

Due to the approach of the time for a new coal agreement between the miners and the operators, with a strike threatening, and also to the cheap price of coal, the coal loadings continued to show an increase over 1923, when they were considered very heavy. Loadings of coal for the week ended Jan. 26 totaled 204,396 cars, an increase of 10,014 cars over the same week of last year. Compared with the corresponding week two years ago, this figure represented an increase of 24,580 cars.

# British Conference Plans Completed

The new Cunard steamer *Scythia*, 20,000 tons, has been chosen to carry the delegates from America to England to attend the World Power Conference in London, June 30 to July 12, and the members of American engineering societies to the Kelvin Centenary functions and summer meetings of the British engineering societies.

The *Scythia* will sail from New York on June 19 and from Boston on the following day. It is due to arrive in Liverpool June 28, thus giving a day or so in London before the opening of the Conference. Although the delegates, as such, to the World Power Conference are limited, the privilege to attend its professional sessions is open to all members of engineering societies upon the payment of a registration fee of ten dollars. This year, also, special invitations have been received from the British engineering societies to attend their respective meetings just after the World Power Conference.

Thos. Cook & Son has been appointed by the British and American Committees of the World Power Conference as the official transportation agents. In addition to securing the control of the *Scythia*, they are arranging for accommodations at London hotels and for a series of attractive official tours which will occur after the Conference is over. These tours will be of both scenic and technical interest. They will particularly include visits to power plants under the auspices of World Power Conference Committees in the various countries of Europe. This is a rare opportunity to secure entrée to plants containing the latest developments, and under the most favorable conditions.

LONDON ENTERTAINMENT

An attractive program of events in London during and immediately following the Conference is being prepared. American visitors will be especially interested in the reception of the American Ambassador in his new residence and the American banquet on the Fourth of July, usually held at the Cecil. The Kelvin Centenary Celebration commences on July 9. This will include a reception at the Royal Society and the presentation on July 11 of the Kelvin Medal to an American, Dr. Elihu Thomson, probably in connection with a banquet attended by representatives of the leading engineering societies of the English-speaking world.

An announcement is being sent to members of the American Society of Mechanical Engineers giving details of transportation arrangements, hotel rates, tours, etc. The opportunity is open to any member of the Society, as well as to his family and friends, to avail himself of the privilege of making this trip in the company of members of this or other engineering societies. On account of the numerous conventions and events scheduled to take place in England this summer in connection with the British Empire Exhibition, it is imperative that Thos. Cook and Son know at the earliest possible moment of the desire of any one to participate. Members are urged to get in touch with them without delay.

A few of those who have already booked passage on the *Scythia* are Ambrose Swasey, Mr. and Mrs. John R. Freeman, Dr. and Mrs. D. S. Jacobus, Mr. and Mrs. John W. Lieb, and Mr. and Mrs. Fred R. Low.

## Safety Code Is Urged for Flying

Legislation providing for an aeronautical safety code, which is held to be essential to the development of commercial aviation, is recommended in a statement issued by the Transportation Department of the Chamber of Commerce of the United States.

"Such legislation," the bulletin states, "will do more than anything else for the encouragement of aeronautics. The United States is the only country of any importance which does not have an aeronautical safety code. Canada has a complete code patterned after the International Convention on Aerial Navigation, and at present United States fliers are permitted in Canada only through international courtesy, and then only after a certificate of inspection has been issued by our Army or Navy."

The advantages to business derived from the expediting of the delivery of mail by aeroplane is emphasized in the bulletin. "From the standpoint of the banker," it continues, "dealing extensively with interest payments in one form or another, speed of movement of mail is an extremely important factor, and any reduction in the time in transit of collections and other security items will benefit business by cutting down the amount of capital required to carry accounts, or by making such capital available for other purposes."

"The National Chamber," the bulletin states in conclusion, "stands for the enactment of suitable enabling legislation by Congress to govern the flight of aircraft and the airways over which they operate, thus encouraging aviation in the development of new services to commerce and as an important means of defense. Given this, the designation of air routes and the assignment of air terminals will naturally follow. Such legislation will not only make for greater safety in flying by eliminating the irresponsible element, but should tend to stimulate commercial aeronautics in all its phases."

## Remington and Noiseless Combine

A new corporation to be known as the Remington Noiseless Corp. has been formed to take over the business of the Noiseless and Remington typewriter companies. Dr. Charles W. Colby, president of the Noiseless Typewriter Co., becomes chairman of the board of the new corporation. All sales will be handled through the existing Remington sales organization. The Noiseless factory at Middletown, Conn., will be continued and will start immediately on a doubled production schedule.

# Research Bureau for Brooklyn Planned

A committee of industrial executives of Brooklyn, representing the Brooklyn Metal Industries Exchange, spent an evening at the Brooklyn Polytechnic Institute, acquainting themselves with the scope of the technical courses and especially the laboratory equipment at the Institute.

The visit of the managers of such plants as the E. W. Bliss Co., the Doehler Die Casting Co., the Eiseman Magneto Corp., the Intertype Corp., the Sperry Gyroscope Co., and others, was more than one of mere curiosity. It was preliminary to the drawing up of a practical plan of co-operation between the industries and the technical school—a plan which, if carried out as contemplated, is likely to be of far-reaching importance both for the industries and for the institute.

In general, of course, the industrial managers appreciate the economic service of the Institute in turning out trained men who will be needed in coming years as executives. The National Industrial Conference Board not long ago issued a bulletin calling to attention that within a few years there will be a serious shortage of men capable of holding executive places in the country's ever-expanding and more and more specializing industrial plant.

But beyond this is the possibility of an alliance between the metal industries and Polytechnic Institute that will be of a definite practical value to both sides. The thought is to establish and develop a metallurgical laboratory at the institute that will engage in research work for the industries, as well as for purely educational purposes. The metal industries have daily problems in the use of metals. New devices constantly being developed call for new uses for metals and experimentation with various metals and their alloys is a growing necessity in the industrial plant.

## Metal Trades Arrange Annual Meeting

The twenty-sixth annual convention of the National Metal Trades Association will be held at the Hotel Astor, New York City, April 23 and 24, according to an announcement that has been mailed out to the members by L. W. Fischer, national secretary.

The convention this year will be faced with many important problems and the program of speeches and discussions that has been arranged is intended to cover as much ground as possible. Taxation, legislation, labor problems, the European situation, industrial training and other allied subjects will be taken up and threshed out by the able speakers who have signified their intention of appearing at this year's meetings.

The social side of the convention has been well taken care of with luncheons, dinners, theatre parties and other diversions so that spare time will not hang heavy on the hands of those attending the convention.

# News of Washington Activities

**By Paul Wooton**

Among other ordnance appropriations which are understood to have been approved by the appropriations committee of the House is one for $50,000 for the purchase of gages. This will enable the Ordnance Department to make the start, at least, toward rounding out the necessary sets of master check and inspection gages essential to the production of material on a divisional basis. One of the weak spots revealed by the last war was the shortage of gages. To supply the deficiency, many poorly designed gages had to be used. The plan now is to build up a stock of gages of best design and which can be relied upon for long service.

A majority of the members of the Military Affairs Committee of the House of Representatives have joined in recommending the passage of the McKenzie bill, which provides for the acceptance of the offer of Henry Ford for the Muscle Shoals properties of the Federal Government.

The Committee amended the McKenzie bill so as to substitute for the Gorgas steam plant and transmission line, a steam plant at lock 17 on the Black Warrior River together with a transformer substation, a transmission line and the necessary right-of-way between dam 17 and nitrate plant No. 2 and the Waco quarry. The expenditures in that connection, however, are not to exceed $3,472,487.25, the amount received by the Government from the Alabama Power Co. for its interest in the Gorgas plant.

### Probable Legislation

Some form of tax revision will be put upon the statute books at this session of Congress. If certain members of each House, who are Republicans in name only, are eliminated, it is evident that the Republican party is in the minority in both the Senate and the House of Representatives. As a result, the Republicans must coalite with someone. This means that concessions from the administration plan must be made unless it should be decided to insist upon that plan or nothing. The probabilities seem to be, however, that the administration leaders will try to get through just as much relief as the opposition will permit.

There is little prospect for railroad legislation at this session. It is very doubtful if there will be any coal legislation. No bill of major importance to the merchant marine is likely to go through. The real truth of the situation is that neither party, on the eve of a presidential campaign, wants to bring forward legislation on any highly controverted matter, if it can be avoided.

### Interesting Suit

The Electric Boat Co. lost its suit to recover from the United States for the use of a patent generator for torpedoes in a decision rendered Jan. 28 by the Supreme Court, sustaining the findings of the Court of Claims. The suit involved a contract entered into in 1912. The court held that the tests of the invention made by the Navy Department had been unsatisfactory, that the contract was limited in scope and that the issue of whether a similar device for the introduction of water into the combustion chamber of a torpedo to increase its range used by the Navy from the E. W. Bliss Co. was not involved in the claim. In the last point, however, the court called attention to the fact that the Bliss company's invention had been tested and found satisfactory by the Navy before the Electric Boat Co. made its offer under the Davison patent.

## British Industries Are Hopeful

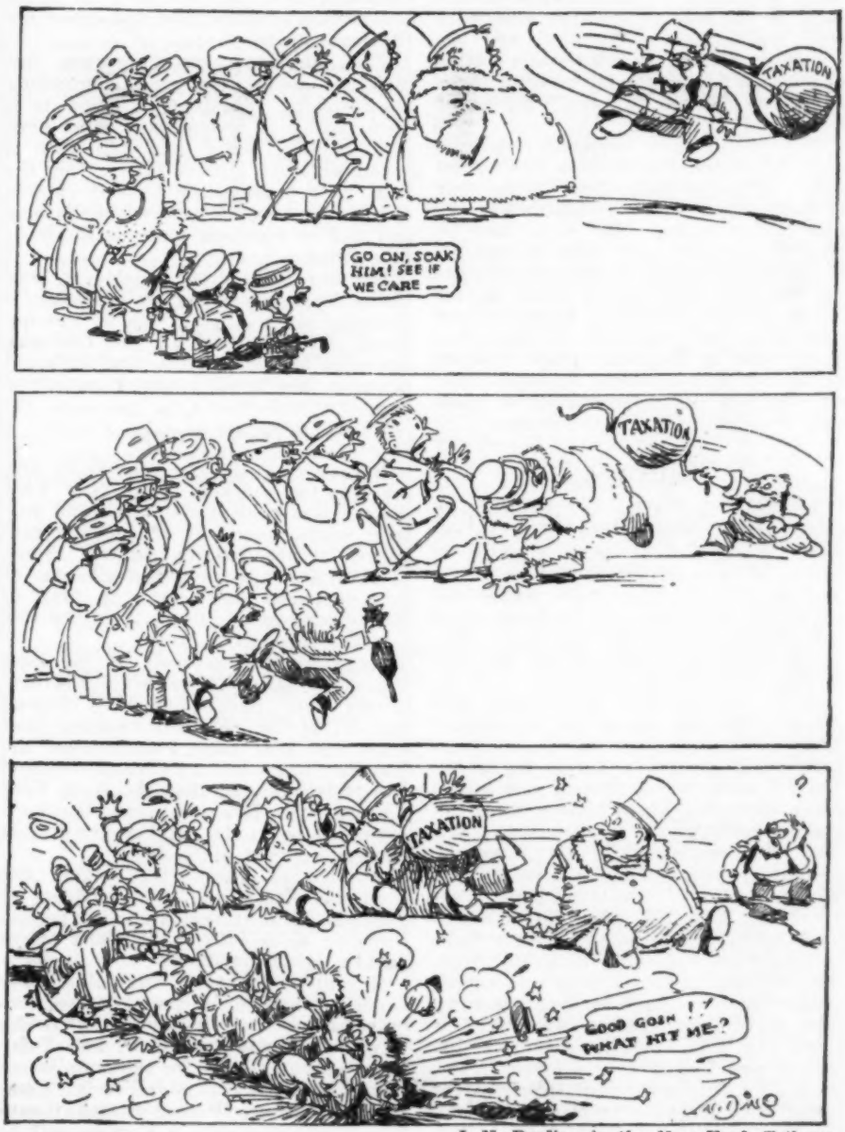
After a most unsettled month, and in spite of the possibility of a dockers strike on Feb. 16, a more hopeful tone is in evidence in British financial and industrial circles, says Acting Commercial Attache H. D. Butler, in a cable to the U. S. Commerce Department. This is due to the settlement of the railroad strike and the announcement of the Labor Government cabinet of a relatively conservative complexion and their prompt assumption of duties. The strike covered nine days and cost the railways approximately £2,000,000. Trade was stagnant and 200,000 men other than railway workers were unemployed because of the strike.

The coal and steel industries are anticipating a steady development during February, provided the dockers do not strike as threatened. Both are busy recovering from the railroad strike.

Automobile production, particularly in light cars for the 1924 season, is well under way, with a considerable increase reported over January of last year. Retail sales have been good and the industry generally is hopeful.

DON'T THINK FOR A MINUTE THE LITTLE FELLOW DOESN'T FEEL IT

Copyright, 1924, New York Tribune Inc.




*J. N. Darling in the New York Tribune*

# The Industrial Review

## *Progress of the machinery and machine-tool business in various parts of the country*

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

### Canada

Production and distribution of machine tools in Canada is quiet at present. January business got under way rather more slowly than usual, this being due in large measure to uncertainty regarding the new sales tax, and to heavier shipments during December, in anticipation of the higher impost.

The steel industry appears to be in a more fortunate position owing principally to the placing of large orders by both the Canadian National and the Canadian Pacific railways, and active production during the next two or three months is assured in most branches of the industry.

The automobile industry covered most of its requirements a few weeks ago, and less is being done in the way of buying this month. Implements are also rather quiet. The same may be said of the pulp and paper industry.

The final figures of Canada's trade for the full year 1923, show an increase of $271,000,000 or nearly 17 per cent when compared with the preceding year, with a favorable trade balance of nearly $125,000,000. Considerably over half of the trade during the past year was with the United States.

### Chicago

Machine tool sales in the Chicago district in January, according to reports from dealers, were slightly in excess of sales during December. Several large lists have been issued recently and February will probably show a material improvement in the market. Used machinery has shown activity during the past week.

It is reported that the Beatty Machine & Manufacturing Co., Hammond, Ind., has closed with the Siams-Stembel Co., Minneapolis, Minn., for about $50,000 worth of machinery and equipment, including about twenty tools for the manufacture of steel railway cars. The Western Electric Co., Chicago, bought an alligator shear from Jos. T. Ryerson & Son. The Automatic Electric Co., Chicago, has purchased a 14-in.x6-ft. engine lathe and ten light milling machines. The Buda Co., Harvey, Ill., has bought a frog and switch planer and a hand milling machine. The A. O. Smith Corp., Milwaukee, is about to close on its extensive list which was issued in November. The Santa Fe Ry. has issued inquiries for about fifty machine tools and is sending out additional lists daily. Purchases will be made for machinery to be used at various points including its new San Bernardino, Cal., shops. The Chicago, Milwaukee & St. Paul Ry. recently made inquiry for about twenty machine tools. The Sullivan Machinery Co., Michigan City, Ind., has inquired for a horizontal boring mill with a 4x4½-in. bar.

### Indianapolis

The new year has started off rather poorly from the standpoint of both machine tool and machinery dealers in Indiana. It seems to have taken the various industries longer to take their inventories and decide on their policies for the coming year than usual. There are two bright spots in the general situation, however. One of these is the automobile industry and the other the furniture industry.

The furniture manufacturers are making many inquiries concerning woodworking machinery. There is a good volume of second-hand machinery of this sort being sold and this is becoming much scarcer than during the last year. Automobile body plants also are making some new installations and will be planning more as the business justifies.

Demand for milling machinery continues brisk, according to Indianapolis manufacturers. For a time it was believed a slump had hit the business, but since the first of the year sufficient business has been received to revive hope.

### New York

Improvement in the machinery and machine tool markets in the New York district was evident this week and further improvement as the month progresses is predicted by dealers. Signs point to a steady buying of all sorts of tools between now and the first of March with good chances to extend this business through to May.

Many of the railroads of the East that have had lists out since the first of the year have commenced buying and all of the old lists hanging over from last year have been cleaned up. Further inquiries are being received and it is rumored that the New York Central, the Erie and one Southern road will be in the market extensively during the next sixty days.

Automotive accessories makers are good customers and this business is now put down as regular and expected, bringing sales into the various offices purely on salesmanship.

A future feature that is being eagerly watched is the Japanese requirements. Many of the buildings are being completed in Tokio and Yokohama and are ready for the installation of machinery and machine tools. Competition between United States' manufacturers and those in Europe will be keen, but manufacturers here have confidence in their ability to overcome price with quality.

The big electric companies are buying good sized quantities of machine tools and some of this business is being felt in the New York district.

### Milwaukee

There is ample evidence of a slowly, but steadily broadening use for tools in Milwaukee in the nature of the patronage coming to foundries and machine shops, especially since the middle of January.

Trade continues to lack the round-lot orders that are counted upon to provide large and steady volume, especially on the production end. The run of orders for single tools, or a few miscellaneous items at one time, is keeping stocks of makers in a fairly well balanced condition. There is considerable milling machine business coming before the trade right along, but it is so widely scattered that makers of this class of tools are unable to make any appreciable headway in advancing production schedules.

Machine tool dealers look for considerable demand from the automotive trade, although it is hardly to be expected that the motor industry will absorb the same number of production instruments as it did in 1923.

The Chicago, Milwaukee & St. Paul Railway recently resumed the buying of shop equipment on a moderate scale.

Local dealers report a fairly active market both in new and used tools during the first half of February.

### Southern District

With considerable improvement noted by the textile industries of the South within the past two or three weeks, there has been a resultant improvement in inquiries from this field for machinery and machine tools, Atlanta distributors state, and the outlook for the first few months of the year is considerably better, therefore, than was the case a month or so ago.

The railroads of the district still are quite active in the market, with inquiries probably a little better than they were a month or so ago, but tool and equipment orders for the shops are holding at about the same level. This business during January has been entirely satisfactory to the dealers, and they are expecting it to remain so for the first half of the year at least.

Inquiries from the smaller machine shops throughout the district are showing signs of further activity.

There have recently been some very good sales of both heavy and light equipment in machine tools in the automotive market, and inquiries being received are in sufficient volume to indicate that the market will continue to show activity for the next few months.

# The Business Barometer

## *This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments*

**By Theodore H. Price**
Editor, *Commerce and Finance*, New York

*(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)*

BY THE death of Woodrow Wilson last week the mind of the world was for a time turned from the contemplation of the things that are temporal to those that are eternal and it was not until Thursday that "business as usual" was resumed.

It may be that Mr. Wilson's passing will have no economic effect, but it may be otherwise. National antagonisms have sometimes been dissolved and at other times crystallized by great national sorrows. It is much to be feared that a German loan in America has been made permanently impossible by the incredibly foolish action of the German Ambassador in refusing to half mast his flag when Mr. Wilson's death was announced.

On the other hand it is quite possible that in their bereavement the people of the United States will be willing to join some league for the world's peace as a tribute to the man they mourn. Should this happen or seem to be probable the effect upon business would be electrical. It is a remote contingency, but it is not unthinkable, nor should it be ignored.

Meantime an impartial review of the week's happenings does not reveal much change in the situation. Most commodities are higher. Cotton is the only exception of importance. It has declined because some much criticized figures issued by the Department of Commerce indicate a surplus instead of a deficiency at the end of the season.

But nearly every other stapie that is officially quoted shows more or less advance. Coffee has been very strong. Wheat is up. So is corn. Raw wool is firmer and seemingly unaffected by the action of the American Woolen Co. in pricing some of its fall goods at a slight decline. Sugar is somewhat higher. The trade papers report increased activity, more orders and prices that are well maintained in the steel industry. Copper is as usual a laggard, but the other non-ferrous metals are higher.

There is some improvement in the demand for dry goods but the easier tendency of the raw cotton market has prevented any advance in cotton fabrics. Mail order houses and chain stores continue to report increased sales, but the retail trade otherwise is quiet. Rubber is firm without being quotably higher.

From their announcements the automobile manufacturers appear to expect an unprecedented demand for their output, although some dealers say that the market is clogged with used cars that are for sale very cheap.

An interesting bit of commercial news is to be found in the testimony given in a law suit in the course of which it was brought out that in 1922 the Radio Corp. of America had sold $22,500,000 of radio equipment through 11,000 retail dealers. The sales for 1923 were probably much larger. This is an example of how quickly a new industry can come to be important in the United States.

The probability that a horizontal reduction of 25 per cent in the income taxes payable on incomes for 1923 will be authorized by Congress is somewhat refreshing in its effect upon a public that had been sickened by the smell of oil—and the flight of de la Huerta to Tuxpam is construed as a confession of defeat that means the collapse of the revolution that threatened Obregon in Mexico.

The news from Europe is also interpreted as favorable to business, and foreign exchange, though still unstable, is no longer panicky. The recognition of the Soviet government by Great Britain is thought to mean improved trade and Russia is reported to be a heavy buyer of raw cotton in Liverpool. An advance in the stock of the International Harvester Co. on the New York Stock Exchange is also regarded as the harbinger of a better understanding between the United States and Russia.

A report that a Japanese loan of $100,000,000 will shortly be brought out in New York and London is considered another auspicious bit of foreign news.

The action of the British Government in ordering the release of Ghandi, the "passive" revolutionist of East India, has a sinister significance in the eyes of some, but it remains to be seen whether this view is justified. In any event its full effect cannot be felt for some time and meanwhile it must be admitted that Premier MacDonald's policy of frankness and conciliation seems to be bringing about a better understanding between France and England.

Speaking generally it may be said that on both sides the Atlantic the spirit of hope and confidence seems to be in the ascendant.

This seems to be reflected by the course of prices on the New York Stock Exchange and in the security markets generally. Good bonds are firm on cheap money and stocks have been easily advanced under the leadership of U. S. Steel, which has sold as high as 109.

It is impossible to specialize, but barring some unlooked for and seemingly improbable disaster it seems reasonable to expect that most stocks that pay dividends will gradually rise to a price that bears a normal relation to their earning power.

This statement is predicated upon the weekly report of the Federal Reserve System, which shows a reserve ratio of 82.1 per cent and earning assets of only $895,363,000 out of total resources of $4,784,628,000.

### *What's Doing in Industry*

**Machinery business in various centers proved to be uneven during the past week with business apparently good in the west, but quiet in New England and only fairly brisk in the New York district. Promises for business are still to be found and it has been pointed out for several weeks that the inquiries being received are bound to bring business.**

**Most attention is centered on the fact that all steel stocks and nearly all automotive stocks reached new highs during the past week and annual statements now being made show that railroads, automobiles, accessories, electrical goods and other lines using machine tools were prosperous ventures.**

**The big electric companies have outlined their expansions for the coming year. Japan is expected to be in the market for all sorts of machinery and machine tools by April. Activity in bus building and the extension of bus lines means an added source of outlet for machine tools.**

**Summarizing January, it was a better month than December, but only about seventy per cent as good as the same month a year ago. February opens with more promise.**

## General Motors Has Record Year

As a result of the largest net sales for any year in its history, totaling $698,000,000, the net earnings for 1923 of the General Motors Corp. were $61,825,000 after making allowance for depreciation and Federal taxes. This compares with sales of $463,706,733 and net profit of $51,496,136 in 1922.

Figures for the net sales and the profits for 1923 were contained in the preliminary report of the company which was made public recently. In it the company stated that the actual operating figures for the first eleven months of the year were taken and estimate made of the twelfth month.

## McMyler Company Making Steam Shovels

The McMyler-Interstate Co. of Bedford, Ohio, has added two new products to those of the Cleveland industrial area—steam shovels and locomotive connecting rods and pistons. The McMyler company has been manufacturing cranes for more than forty years.

The manufacture of connecting rods and pistons required the addition of a new department to the Bedford works, Justin Griess, vice-president of the company, said. The forging facilities of the plant made the business a logical one, but special machinery had to be added for the locomotive work.

# Personals

GEORGES MARIE HAARDT, general manager of André Citröen, well known French automobile manufacturer, is in this country with E. R. FREDERICKS and a staff of fifteen engineers for a three weeks stay. A number of plant visits will be made to determine what equipment should be purchased for proposed extensions to the Citröen plant.

WILLIAM L. SAUNDERS, chairman of the Naval Consulting Board and deputy chairman of the Federal Reserve Bank of New York, has been elected president of the United Engineering Society, succeeding J. VIPOND DAVIES. Mr. Saunders is chairman of the Board of the Ingersoll-Rand Company, and a director of other large corporations.

HOBART AMES, for the past 23 years president of the Ames Shovel & Tool Co., Boston, Mass., has resigned, but will remain a director of the company.

FRANK B. ZELLER, formerly purchasing agent of the New York Air Brake Co., New York City, has joined the organization of the McLean Manufacturing Co., New York City.

CHARLES H. WAGNER has been appointed sales manager of the American Fork & Hoe Co., Cleveland, Ohio, succeeding Silas Reimer, deceased.

H. P. POPE has resigned as western representative of the Thomas Spacing Machine Co., Pittsburgh, Pa.

GUY E. TRIPP, chairman of the board of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., sailed for the United States from England on Feb. 6. Mr. Tripp has been in Japan since October where he was instrumental in effecting the big electrical merger.

E. A. WURSTER has resigned as secretary and treasurer of the Falk Corp., Milwaukee, Wis.

O. W. HEIMBERGER is with the Griscom-Russell Co. at Massillon, Ohio.

G. BREWER GRIFFIN has been elected president of the Motor Accessory Manufacturers' Association. Mr. Griffin is the manager of the automotive equipment department of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

GEORGE W. MIXTER, formerly of the Pierce-Arrow Motor Car Co., Buffalo, has become associated with Day & Zimmerman, to give special attention to industrial work. His headquarters will be at the New York offices of the company.

ROBERT CRAIG has resigned his position as chief engineer for the Dayton Scale Co., Dayton, Ohio, to open an office as a consulting mechanical engineer in Dayton.

HERBERT C. SNOW has been appointed chief engineer of the Velie Motors Corp., Moline, Ill.

J. B. MANSFIELD, formerly president of the Mansfield Steel Co. and the Detroit Trailer Co., has opened offices in Detroit as a consulting engineer.

CLARENCE R. FALK has been named secretary and treasurer of the Falk Corp., Milwaukee, Wis.

H. W. FARROW has been appointed general superintendent of the engine factory of the Veile Motors Corp. at Marion, Ind.

J. J. SIMMONS has been appointed acting assistant master mechanic of the Hannibal division of the Chicago, Burlington & Quincy R.R. with headquarters at Hannibal, Mo.

M. F. COX has been appointed assistant superintendent of machinery of the Louisville & Nashville R.R., with headquarters at Louisville, Ky.

FEODORE F. FOSS has left Washington to open an office in Wheeling, W. Va.

WILLIAM A. HARRIS, JR., of Springfield, Mass., will leave soon for an extended trip abroad.

ALFRED C. HOWELL, formerly with the Bethlehem Steel Co., has been appointed president of the Ames Shovel & Tool Co., Boston, Mass.

LOUIS L. BROWN has been elected president of the Star Furnace Co., Jackson, Ohio, to succeed CHARLES O. BROWN who died last November. Walter T. Brown is manager and Homer L. Davis secretary.

W. AUBREY THOMAS was elected president of the Mahoning Valley Steel Co., Warren, Ohio, to succeed J. D. WADDELL, resigned.

EARL S. MACHIN, assistant manager at the New Castle, Ohio, works of the American Sheet & Tinplate Co. has been appointed acting manager of the Laughlin works of the same company at Martin's Ferry, Ohio.

F. A. HOMANN is sales representative in Philadelphia for the Herman Nelson Corp. of Moline, Ill.

ROBERT H. CAMPBELL, formerly of Chicago, is now connected with the Frontenac Sales Co. of Newark, N. J.

W. H. PATTERSON has joined the John H. Dunham Co., Wrigley Building, Chicago, an advertising agency, as vice-president. Mr. Patterson was with the Westinghouse Electric & Manufacturing Co. for a number of years as manager of the resale-industrial sales department. Recently he was with the Kaestner & Hecht Elevator Co., Chicago.

E. F. W. ALEXANDERSON, consulting engineer of the General Electric Co. and chief consulting engineer of the Radio Corp. of America, has been awarded the Order of the Polonia Restituta, by the Polish Government, in recognition of his meritorious services in connection with the building of Poland's new radio station near Warsaw.

# Obituaries

KARL W. MOYNES, aged 42 years, Brookline, Mass., died Feb. 1 at Marblehead, Mass., of a nervous disorder. Mr. Moynes was president of the Union Drawn Steel Co., Boston, Mass., where he was active until a few days before his death.

# Business Items

The general sales and executive offices of the Consolidated Machine Tool Corp. of America have been moved from the Betts plant at Rochester, N. Y., to the Hilles & Jones plant, Wilmington, Del. H. J. Bailey, president of the Consolidated corporation is also head of the Hilles & Jones Co., one of the units.

The jobbing machine business formerly conducted by Herbert M. Darling, Greenfield, Mass., has been combined with the Bicknell-Thomas Co., Greenfield, Mass., and will be under the management of Leon E. Turner.

The U. T. Hungerford Brass & Copper Co. has opened a Cleveland Warehouse.

The Collingwood Shipbuilding Co., Collingwood, Ont., has been given a contract by the Matthews Steamship Co. for the construction of a lake freighter of the largest type that sails upon the Great Lakes. The steamer including engines and boilers will be constructed in Collingwood, and the work will be commenced immediately.

The Horton Steel Works Ltd. is proceeding at Bridgeburg, Ontario, with the construction of a new main building 66x260 ft., and with the purchase of modern machinery, to take the place of that recently destroyed by fire. Under the direction of E. G. Daniels, mechanical engineer and designer of steel-fabricating machinery, the company is rebuilding all machines that were not completely destroyed.

The Canadian Pacific Railway roundhouse and sixteen locomotives at Schreiber, Ontario, were destroyed by fire Jan. 23. The loss was approximately $200,000.

The plant of the U. S. High Speed Steel & Tool Corp., Green Island, N. Y., has been purchased by the Simmons Machine Co., Albany, N. Y. Officials of the company stated that work at the Green Island plant would be resumed within a short time.

The outlook for the future of the Canadian Car & Foundry Co. Ltd., is very bright, according to the remarks of President W. W. Buttler at the fourteenth annual general meeting. Mr. Buttler stated that at Sept. 30, the end of the company's fiscal year, the business carried over amounted to $7,500,000, and that since then $4,000,000 of new business had been obtained. He pointed out that gross sales during the past year were in excess of $20,000,000, as compared with somewhat over $9,000,000 in the preceding year. During 1923, the company built 17,000 freight cars.

## England Buying More American Machinery

Because British manufacturers occupy such a very important position as exporters of machinery, there is a tendency to overlook the large volume of machinery exported from the United States to the United Kingdom and this applies to a very wide range of machinery, says the Industrial Machinery division of the U. S. Commerce Department. Even in pre-war years these exports were very heavy. In 1910, the United Kingdom ranked third among all the foreign markets for American machinery absorbing more than $4,500,000 worth of American equipment. By 1913 the United Kingdom occupied second position, absorbing more than $10,400,000 worth of such macinery.

During the war period this trade became very heavy for obvious reasons, but even in 1922 the United Kingdom still ranked second in importance, absorbing $12,791,732 worth of American machinery. It might be added that generally speaking the machinery exported from the United States to the United Kingdom represents our better classes of equipment, such as machine tools used either for large production or precision production, labor saving equipment or any one of a great variety of specialties produced in the United States.

The volume of the machinery imports of the United States is large, being for 1922 about $21,500,000 for strictly industrial machinery. But, although this machinery is drawn from a great variety of sources, the United States occupies an exceedingly important position in this trade, furnishing nearly two-thirds of these imports into the United Kingdom. The details are shown roughly in the following table:

| Country | Percentage |
|---|---|
| United States | 65.5 |
| France | 19.0 |
| Germany | 6.5 |
| Sweden | 4.0 |
| All other countries | 5.0 |

It should be remembered, of course, that a certain amount of this machinery reported as being imported into the United Kingdom, is re-exported, but this trade is very much smaller than formerly as a study of the statistics will show. In 1913, re-exports amounted to about 35 per cent, while in 1922 it would appear that the re-exports were only about 15 per cent. Changing labor conditions and other conditions in the United Kingdom are encouraging manufacturers there to clear their stocks for better classes of machinery, attention being given particularly to labor-saving machinery; and it will probably be observed that conditions in the United Kingdom are becoming more and more like those in the United States, making the employment of our types of machinery more desirable in the shops of the United Kingdom than was formerly the case.

## Trade Catalogs

**Electric Motors.** The Fuerst-Friedman Co., 1251 West Third St., Cleveland, Ohio. This company is mailing out cards that may be filed or hung up in the shop, each card containing pertinent information regarding motors, their installation, repair and care, the whole series being a valuable collection on these subjects.

**Molding Machines.** The Adams Co., Dubuque, Iowa. This is a folder with illustrations and sectional photographs showing the Adams Air Squeezer for use in foundries. Specifications and information for foundrymen is to be found in the folder.

**Indicating Instruments for Direct and Alternating Currents.** The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. A 24-page booklet printed in two colors and known as Circular 1664 pertaining to the above listed subject has recently been issued. The research that resulted in these new instruments is related and the instruments themselves are minutely described.

**Drilling Machines.** The Henry & Wright Manufacturing Co., Hartford, Conn. A very neat folder describing the Viktor drilling machine with a half-tone illustration showing the product. There is also a page devoted to a detailed description of the machine.

## Pamphlets Received

**Census of Manufactures, 1921; Iron and Steel.** Department of Commerce, Government Printing office, Washington, D. C. Production, cost of operation, capital, numbers employed, wages paid, and other intimate data regarding blast furnaces, steel works, rolling mills and other classifications of iron and steel manufacturers are contained in this report.

**Employment in Selected Industries.** Department of Labor, Government Printing Office, Washington, D. C. This pamphlet tells in detail the amount of employment during December, 1923. The report is based upon figures obtained from 7,408 establishments in 52 manufacturing industries employing 2,448,370 people. It shows a slight decrease during the month as compared with the November figures.

**The Effect of Electrode Temperature on the Sparking Voltage of Short Spark Gaps.** F. B. Silsbee. National Advisory Committee for Aeronautics, Washington, D. C. This is report No. 179 and presents the results of an investigation carried on at the Bureau of Standards to determine what effect the temperature of spark plug electrodes might have on the voltage at which a spark occurred. A copy of the report may be obtained upon request from the National Advisory Committee of Aeronautics, Washington, D. C.

## Iron and Steel Exports

Over one-half of the iron and steel shipments of the United States for the entire year 1923 went to the main American markets, Canada, with 760,400 tons being far in advance of any other export field, according to the Iron and Steel Division of the Department of Commerce. Cuba was responsible for 171,900 tons, Mexico for 84,600 tons, Argentina for 53,700 tons, Brazil for 50,500 tons, and Chile for 33,900 tons. The United Kingdom took 63,000 tons of iron and steel from producers in the United States. Exports to Japan increased heavily during the last quarter due in part to needs for reconstruction after the earthquake. Japan's total for the year was 360,000 tons, of which 160,000 tons were shipped during October, November and December.

## Export Opportunities

**The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.**

Hydraulic turbine and irrigation pumps. Manila, Philippine Islands. Agency. Reference No. 9024.

Labor-saving construction machines and tools. Algiers, Algeria. Purchase. Reference No. 9050.

## Forthcoming Meetings

**National Metal Trades Association.** Twenty-sixth annual convention. Hotel Astor, New York City, April 23 and 24. L. W. Fischer, National Secretary, Peoples Gas Building, Chicago, Ill.

**American Gear Manufacturers Association.** Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

**Society of Industrial Engineers.** Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

**American Society of Mechanical Engineers.** Spring meeting. Cleveland, Ohio. May 19, 20, 21 and 22. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

**Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association.** Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

**Foreign Trade Council.** Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

**The General Committee of Division V, Mechanical of the American Railway Association.** Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

**Railway Supply Manufacturers Association.** Exhibit. Atlantic City, June 11-18, 1924.

**The Lyons Fair.** Lyons, France, March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

**American Society for Steel Treating.** Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4,600 Prospect Ave., Cleveland, Ohio.

# The Weekly Price Guide

## *Rise and Fall of the Market*

**Iron and Steel**—Heavy pig-iron inquiries still pervade market. Much foreign iron being used. Minimum on No. 2 foundry iron $23 per ton at Birmingham, against $22, recently. Steel plate demand confined mostly to small tonnages at present. Railroads and ship builders taking bulk of output. Plates quoted at $2.40@$2.50 per 100 lb., Pittsburgh; as low as $2.30, however, has been recently done. Structurals, $2.50, with some reports of shading to $2.40 per 100 lb. at mill. Bars firm at $2.40.

**Advances**—General upward trend in all non-ferrous metals. Tin market highest since May, 1920. Lead in strongest position realized since war. Rise in metals reflected in advances in zinc sheets and babbitt metal, at New York and Cleveland warehouses.

**Declines**—Dealers' purchasing prices of brass and copper scrap slightly lower in New York and Cleveland.

## IRON AND STEEL

**PIG IRON**—Per gross ton—Quotations compiled by The Matthew Addy Co.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $25.05 |
| Northern Basic | 24.00 |
| Southern Ohio No. 2 | 24.00 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 28.00 |
| BIRMINGHAM | |
| No. 2 Foundry | 23.00 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 24.25 |
| Virginia No. 2 | 28.17 |
| Basic | 24.00 |
| Grey Forge | 24.00 |
| CHICAGO | |
| No. 2 Foundry local | 24.50 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 27.00 |
| PITTSBURGH, including freight charge from Valley | |
| No. 2 Foundry | 25.77 |
| Basic | 25.77 |
| Bessemer | 26.77 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.50@4.75 |
| Cleveland | 4.50@4.75 |
| Cincinnati | 5.00@7.50 |
| New York | 5.00@5.50 |
| Chicago | 5.25@5.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

| Blue Annealed | Pittsburgh | New York | Cleveland | Chicago |
|---|---|---|---|---|
| No. 10 | 3.00 | 4.34 | 3.75 | 4.00 |
| No. 12 | 3.10 | 4.39 | 3.80 | 4.05 |
| No. 14 | 3.20 | 4.44 | 3.85 | 4.10 |
| No. 16 | 3.40 | 4.54 | 3.95 | 4.20 |
| Black | | | | |
| Nos. 17 and 21 | 3.70 | 4.55 | 4.45 | 4.70 |
| Nos. 22 and 24 | 3.75 | 4.60 | 4.50 | 4.70 |
| Nos. 25 and 26 | 3.80 | 4.65 | 4.55 | 4.75 |
| No. 28 | 3.85 | 4.75 | 4.65 | 4.85 |
| Galvanized | | | | |
| Nos. 10 and 11 | 4.00 | 4.80 | 4.70 | 4.85 |
| Nos. 12 and 14 | 4.10 | 4.90 | 4.80 | 4.95 |
| Nos. 17 and 21 | 4.40 | 5.20 | 5.10 | 5.24 |
| Nos. 22 and 24 | 4.55 | 5.35 | 5.25 | 5.40 |
| No. 26 | 4.70 | 5.45 | 5.50 | 5.55 |
| No. 28 | 5.00 | 5.75 | 5.80 | 5.85 |

**WROUGHT PIPE (Welded)**—Warehouse discounts are as follows:

| | New York | | Cleveland | | Chicago | |
|---|---|---|---|---|---|---|
| | Black | Galv. | Black | Galv. | Black | Galv. |
| 1 to 3 in. steel butt welded | 48% | 34% | 55½% | 43½% | 50% | 37% |
| 2½ to 6 in. steel lap welded | 44% | 30% | 53½% | 40½% | 47% | 34% |

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

**SEAMLESS STEEL TUBING**—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

| O.D. Inches | List Price per ft. | Differential Discount | O.D. Inches | List Price per ft. | Differential Discount |
|---|---|---|---|---|---|
| ¼ | $0.09 | 50% | ⅞ | $0.16 | 35% |
| ⅜ | .11 | 45% | 1 | .18 | 31% |
| ½ | .14 | 40% | | | |

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Open hearth spring steel (base) | 4.50 | 6.00 | 4.20 |
| Spring steel (light) (base) | 7.00 | 6.00 | 6.00 |
| Coppered Bessemer rods (base) | 6.53 | 8.00 | 6.70 |
| Hoop steel | 5.19 | 4.66 | 4.55 |
| Cold rolled strip steel | 7.50 | 8.25 | 8.35 |
| Floor plates | 5.80 | 5.66 | 5.80 |
| Cold drawn shafting or screw | 4.40 | 3.90 | 4.30 |
| Cold drawn flats, squares | 4.90 | 4.40 | 4.80 |
| Structural shapes (base) | 3.64 | 3.46 | 3.30 |
| Soft steel bars (base) | 3.54 | 3.36 | 3.20 |
| Soft steel bar shapes (base) | 3.54 | 3.36 | 3.20 |
| Soft steel bands (base) | 4.39 | 3.61 | 3.95 |
| Tank plates (base) | 3.64 | 3.46 | 3.30 |
| Bar iron (3.10@3.15 at mill) | 3.54 | 3.36 | 3.20 |
| Tool steel | 11.00 | .... | .... |
| Drill rod (from list) | 55% | 40@55% | 50% |

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

## METALS

Current Prices in Cents Per Pound

| | | | |
|---|---|---|---|
| Copper, electrolytic (up to carlots), New York | | | 13.12½ |
| Tin, 5-ton lots, New York | | | 54.00 |
| Lead (up to carlots), St. Louis | 8.40 | New York | 8.87½ |
| Zinc (up to carlots), St. Louis | 6.65 | New York | 7.50 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum, 98 to 99% ingots, 1-15 ton lots | 26.20 | 29.00 | 28.50 |
| Antimony (Chinese), ton spot | 11.50 | 13.00 | 10.25 |
| Copper sheets, base | 20.50 | 20.75 | 23.00 |
| Copper wire, base | 16.00 | 18.50 | 16.25 |
| Copper bars, base | 19.50 | 22.00 | 19.50 |
| Copper tubing, base | 22.50 | 26.75 | 23.00 |
| Brass sheets, base | 17.25 | 21.50 | 18.75 |
| Brass tubing, base | 21.50 | 26.50 | 20.50 |
| Brass rods, base | 15.00 | 17.50 | 15.75 |
| Brass wire, base | 17.75 | 21.50 | .... |
| Zinc sheets (casks) | 10 75 | 10.80 | .... |
| Solder (½ and ½), (case lots) | 36.75 | 33.75 | 30.00 |
| Babbitt metal (83% tin) | 60.00 | 62.00 | 48@52 |
| Babbitt metal (35% tin) | 28.00 | 20.50 | 22@25 |
| Nickel (ingot and shot) | 29.00 | .... | .... |
| Nickel (electrolytic) | 32.00 | .... | 35.00 |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb.

| | |
|---|---|
| Malleable nickel sheet (base) | 57.00 |
| Hot rolled rods, Grade "A" (base) | 55.00 |
| Cold drawn rods, Grade "A" (base) | 63.00 |

# Shop Materials and Supplies

## METALS—Continued

| | |
|---|---|
| Copper nickel ingots | 37.00 |
| Hot rolled copper nickel rods (base) | 45.00 |
| Manganese nickel hot rolled rods "E"—low manganese (base) | 57.00 |
| Manganese nickel hot rolled rods "D"—high manganese (base) | 60.00 |

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

| | | | |
|---|---|---|---|
| Shot | 32.00 | Hot rolled rods (base) | 40.00 |
| Blocks | 32.00 | Cold drawn rods (base) | 48.00 |
| Ingots | 38.00 | Hot rolled sheets (base) | 42.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Copper, heavy, and crucible | 10.12½ | 10.75 | 11.50 |
| Copper, heavy, and wire | 9.62½ | 10.25 | 10.75 |
| Copper, light, and bottoms | 7.62½ | 8.50 | 9.75 |
| Lead, heavy | 7.00 | 6.50 | 6.00 |
| Lead, tea | 4.37½ | 4.00 | 5.00 |
| Brass, heavy, yellow | 5.00 | | 7.25 |
| Brass, heavy, red | 7.00 | 9.00 | 9.00 |
| Brass, light | 4.25 | 5.00 | 6.25 |
| No. 1 yellow brass turnings | 4.75 | 5.00 | 6.75 |
| Zinc | 3.75 | 3.00 | 3.75 |

**TIN PLATES**—American Charcoal—Bright—Per box.

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Grade: | | | | |
| IC, | 20x28, 112 sheets | $25.10 | $22.85 | $18.50 |
| "A" Grade: | | | | |
| IC, | 20x28, 112 sheets | 21.40 | 18.00 | 17.00 |
| | Coke Plates—Primes, 20x28 in. | | | |
| 100-lb., | 112 sheets | 14.00 | 13.00 | 14.50 |
| | Terne Plates—Small lots, 8-lb. Coating | | | |
| IC, | 14x20 | 8.25 | 6.55 | 7.40 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.14@0.21 | $0.20 | $0.14 |
| Cotton waste, colored, per lb. | .09@.12½ | .17 | .10½ |
| Wiping cloths, 13¼x13¼, per lb | 11.00 | 36.00 per M | .16 |
| Wiping cloths, 13¼x20½, per lb. | 11 50 | 52.00 per M | .16 |
| Sal soda, per 100 lb. | 2.40 | 2.25 | 2.65 |
| Roll sulphur, per 100 lb. | 3.60 | 3.25 | 3.50 |
| Linseed oil, per gal., 5 bbl. lots | .95 | 1.00 | .94 |
| Lard cutting oil, 25% lard, per gal. | .58 | .50 | .67½ |
| Lard oil, pure, per gal, 2 to 5 bbl. lots | .80@1.35 | 1.01 | .97 |
| Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal. | .29 | .35 | .40 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, 2c. per sq.in., per ply: | | | |
| Medium grade | 40–2½% | 30–10% | 30–10% |
| Heavy grade | 30–5% | 30% | 20–5–2½% |
| Rubber and duck: | | | |
| First grade | 50–5% | 50–10% | 40–10% |
| Second grade | 50–10% | 60–5% | 60–5% |
| Abrasive materials—In sheets 9x11 in., | | | |
| No. 1 grade, per ream of 480 sheets: | | | |
| Flint paper | $6.30 | $5.84 | $6.48 |
| Emery paper | 9.90 | 11.00 | 8.80 |
| Emery cloth | 31.12 | 31.12 | 29.48 |
| Emery disks, 6 in. dia., No. 1 grade, per 100: | | | |
| Paper | 1.49 | 1.24 | 1.40 |
| Cloth | 3.38 | 2.67 | 3.20 |
| Fire clay, per 100 lb. bag | | .65 | .60 |
| Coke, prompt furnace, Connellsville | per net ton | | 4.00@4.50 |
| Coke, prompt foundry, Connellsville | per net ton | | 5.25@6.50 |
| White lead, dry or in oil | 100 lb. kegs | New York, | 14.50 |
| Red lead, dry | 100 lb. kegs | New York, | 14.50 |
| Red lead, in oil | 100 lb. kegs | New York, | 16.00 |

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.0354 | $0.0354 | $0.0319 |
| Cold finished shafting | per lb. | 0.044 | 0.044 | 0.0405 |
| Brass rods | per lb | 0.15 | 0.155 | 0.1725 |
| Solder (½ and ½) | per lb. | 0.3675 | 0.3375 | 0.29 |
| Cotton waste | per lb. | .14@.21 | .11@.14 | .10@.13 |
| Washers, cast iron (½ in.) | per 100 lb. | 6.50 | 6.50 | 6.00 |
| Emery, disks, cloth, No. 1, 6 in. dia. | per 100 | 3.38 | 3.38 | 3.02 |
| Lard cutting oil | per gal. | 0.58 | 0.55 | 0.55 |
| Machine oil | per gal. | 0.29 | 0.29 | 0.297 |
| Belting, leather, medium | off list | 40–2½% | 40–2½% | 30–10% |
| Machine bolts up to 1x30 in. | off list | 45% | 45% | 40% |

## SHOP SUPPLIES

Current Discounts from Standard Lists

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Machine Bolts: | | | |
| All sizes up to 1x30 in. | 45% | 60% | 50–5% |
| 1¼ and 1¼x3 in. up to 12 in | 15% | 50–5% | 50% |
| With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%) | 30% | $3.50 net | ..... |
| With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%) | 35% | 3.50 net | $4.00 off |
| Button head bolts, with hex. nuts | List net | List net | ..... |
| Hex. head and hex. nut bolts | List net | ..... | 65–5% |
| Lag screws, coach screws | 45% | ..... | 60–5% |
| Square and hex. head cap screws | 60% | 70% | 70–10% |
| Carriage bolts, up to 1 in.x30 in. | 35% | 50% | 50–5% |
| Bolt ends, with hot pressed nuts | 45% | ..... | 55% |
| Tap bolts, hex. head, list plus | 35% | ..... | ..... |
| Semi-finished nuts, 5/16 and smaller | 65% | ..... | ..... |
| Semi-finished nuts, ⅜ and larger | 60% | 70% | 80% |
| Case-hardened nuts | 50% | ..... | ..... |
| Washers, cast iron, ½ in., per 100 lb. (net) | $6.50 | $4.00 | $4.00 |
| Washers, cast iron, ⅝ in., per 100 lb. (net) | 5.50 | 4.00 | 4.00 |
| Washers, round plate, per 100 lb. Off list | 1.50 | 4.00 | 4.00 |
| Nuts, hot pressed, sq., per 100 lb. Off list | 1.00 | 3.50 | 3.50 |
| Nuts, hot pressed, hex., per 100 lb. Off list | 1.00 | 3.50 | 3.50 |
| Nuts, cold punched, sq., per 100 lb. Off list | 1.00 | 3.50 | 3.50 |
| Nuts, cold punched, hex., per 100 lb. Off list | 1.00 | 3.50 | 3.50 |
| Rivets: | | | |
| Rivets, 7/16 in. dia. and smaller | 50% | 60% | 60% |
| Rivets, tinned | 50% | 60% | 4½c. net |
| Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net) | $5.00 | $3.60 | $3.75 |
| Cone heads, ditto (net) | 5.20 | 3.80 | 3.85 |
| 1½ to 2-in. long, all diameters, *EXTRA* per 100 lb. | 0.25 | ..... | 0.15 |
| ⅝ in. diameter *EXTRA* | 0.35 | ..... | 0.15 |
| ¾ in. diameter *EXTRA* | 0.75 | ..... | 0.50 |
| 1 in. long, and shorter *EXTRA* | 0.75 | ..... | 0.50 |
| Longer than 5 in. *EXTRA* | 0.50 | ..... | 0.25 |
| Less than 200 lb. *EXTRA* | 0.50 | ..... | 0.50 |
| Countersunk heads *EXTRA* | 0.45 | ..... | $3.70 base |

# New and Enlarged Shops

## Machine Tools Wanted

**Calif., Redding** — W. E. Bewsher, 617 California St.—machine shop equipment for proposed garage.

**Ind., Michigan City**—Sullivan Mchy. Co.—horizontal boring mill.

**Mass., Brookline** (Boston P. O.)—C. A. Pendleton, 13 Washington St. (machine shop)—power key making machine and baby carriage tire machine.

**N. Y., Buffalo** — S. Fizak, Bway. and Hirschbeck St.—drill press and small lathe for automobile repair shop.

**N. Y., Buffalo**—S. Lipowicz, 761 Fillmore Ave.—drill press and grinder for garage.

**N. Y., Hoosick Falls**—Lovejoy Chaplet Co., L. Brownell, Secy.—one automatic screw machine same as B. & S. No. 00, complete with drives, etc.

**N. Y., New York**—Hardware Stamping Co., 182 Ave. C—power squaring shear, 30 to 36 in.

**N. Y., New York**—Wilson Mfg. Co., 137 Grand St. (manufacturer of tools and dies). A. Wilson, Purch. Agt.—Bliss press, No. 21 D or a V. & O. press.

**O., Canton**—Gilliam Mfg. Co., 820 Savannah Ave., N. E., B. T. Steiner, Pres.—roller bearing machinery, including boring machines, grinding apparatus, drills, etc., for proposed addition to plant.

**Ont., Toronto**—Rice Wire & Metal Goods, Ltd., 10-16 Plymouth Ave., J. W. Fitzgerald, Secy.—power brake press, to take 30 x 84 in. sheet.

## Machinery Wanted

**Calif., Oakland** — Marchant Calculating Machine Co., Powell and Landregan Sts.—complete equipment and traveling crane, about 10 ton, for proposed $50,000 foundry.

**Conn., Rockyhill**—Belamose Corp.—looms, spindles, etc., for new cotton mill.

**Ky., Louisville**—Office of United States Engineer, P. O. Box 72—one single stage straight line air compressor, capacity 110 cu.ft. air per min. at pressure of 100 lb., for Dam 45, f.o.b. Addison.

**Mass., Boston**—New England Fuel & Transportation Co., 11¼ Devonshire St., address purchasing agent—electrically operated endless chain conveying machinery and equipment for new coke screening plant at Everett.

**Mass., Cambridge** — Barbour-Stockwell Co., 205 Bway. (manufacturer of railroad supplies)—metal and woodworking equipment for new plant.

**Mich., Alston**—Christiansen Lumber Co.—resaw, rip saw and bandsaw mill.

**Pa., Kane**—Miles-Kane Co., Fraley St.—complete refrigeration equipment for proposed $75,000 produce warehouse.

**Wis., Algoma**—Algoma Wood Products Co., C. Schmitt, Secy.—woodworking machinery for proposed $60,000 factory.

**Wis., Cornell**—A. Fox—drills, gasoline storage tanks, pumps and tire press for proposed $50,000 garage.

**Wis., Eau Claire**—Dells Paper & Pulp Co., Dells Dam, E. O'Brien, Purch. Agt.—one electric traveling gate hoist.

**Wis., Fennimore**—Mount Hope Butter & Cheese Co., c/o W. M. Peacock—electrically driven refrigeration machinery.

**Wis., Hartland**—Hornberg Motor Co—air compressor, tanks and small tools for proposed $40,000 additions to garage.

**Wis., Milwaukee**—G. W. Nuezerling, 734 37th St.—lathe, sander and mortiser for woodworking plant.

**Wis., West Allis**—Rosenthal Corn Husker Co., 7424 Elm St.—moulding machines and forge for proposed $40,000 foundry.

**Ont., Sudbury**—Sudbury S. & V. Wks., Ltd., H. W. McDonald, Purch. Agt.—vulcanizing and welding equipment.

**Que., East Clifton**—F. Frechette—shingle and sawmill machinery.

**Que., Laurierville**—W. St. Pierre (sawmill)—cutoff saw, moulder and rip saw.

**Que., Magog**—Martin & Wallace (planing mill)—cutoff saw, planer, circle saw, etc.

**Que., St. Malo**—P. Boucher (sawmill)—bandsaw, resaw and belting.

## Metal Working Shops

**California**—The Western Pacific R.R Co., Mills Bldg., San Francisco, has appropriated $6,000,000 for 1924 improvements, including shops, etc., at various points here, also in Nevada and Utah. J. W. Williams, Ch. Engr.

**Calif., Burbank**—The Clark-Turner Piston Co., 2251 East 7th St., Los Angeles, has had plans prepared for the construction of a 1 story, 50 x 250 ft. factory on Olive St., here. Austin Co. of California, Bartlett Bldg., Los Angeles, Engrs.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

**BUSINESS NEWS DEPARTMENT**
**Tenth Ave. at 36th St., New York**

**Calif., Los Angeles**—W. Shortsleeve, et al., 810 South Grand Ave., awarded the contract for the construction of an 8 story garage. Estimated cost $250,000. Noted Feb. 7.

**Calif., Oakland**—E. W. Cannon, Archt., Central Bank Bldg., is receiving bids for the construction of a 1 story garage on Bway. near Orchid St. for M. E. Roberts, 1632 East 19th St. Estimated cost $40,000.

**Calif., Oakland**—The Marchant Calculating Machine Co., Powell and Landregan Sts., is having plans prepared for the construction of a 1 story foundry on 10th Ave. near High St. Estimated cost $50,000. Private plans.

**Calif., Redding** — W. E. Bewsher, 617 California St., plans to build a 1 story, 150 x 300 ft. garage on Placer, California and Sacramento Sts. Estimated cost $100,000, including equipment.

**Ind., Evansville** — The Bucyrus Steam Shovel Co., Decker Rd., plans to build a 1 story machine shop.

**Ind., Michigan City**—The Prince Motor Co., 1103 Jackson St., is having plans prepared for the construction of a 2 story, 100 x 125 ft. repair shop and service station on Jefferson St. Estimated cost $75,000. Nicol, Scholer & Hoffman, Ross Bldg., Lafayette., Archts.

**Ky., Ferguson**—The Southern R.R. Co., Southern R.R. Bldg., Cincinnati, O., awarded the contract for the construction of a 1 story addition to its car repair shops, here. Estimated cost $65,000. Noted Jan. 31.

**Ky., Louisville**—The Lee Tire & Rubber Co., 3rd St., plans to build a 2 story, 53 x 140 ft. garage and service station at 551 South 1st St. Estimated cost $75,000.

**Mich., Detroit**—Esselstyn & Carey, Engrs., 2539 Woodward Ave., are receiving bids and will open same about Feb. 15 for the construction of a 2 story, 60 x 160 ft. addition to factory for the manufacture of seamless brass tubing for the Wolverine Tube Co., 1411 Central Ave.

**Minn., Mankato**—The Standard Oil Co. of Indiana, Davidson and Lord Sts., Indianapolis, plans to build shops, garage, etc., here. Estimated cost $150,000. J. J. Meyer, local representative.

**Mo., St. Louis**—A local syndicate, c/o B. Altheimer & Bro. Realty Co., Wainwright Bldg., will soon receive bids for the construction of a 3 story, 147 x 188 ft. garage on Lucas Ave. Estimated cost $175,000.

**Mo., St. Louis**—The Measuregraph Co., 1821 Olive St., awarded the contract for the construction of a 2 story, 80 x 180 ft. factory for the manufacture of measuring machines, etc., on Forest Park St. Estimated cost $60,000.

**Neb., Superior**—B. C. Robinson plans to build a battery service and tire repair shop.

**N. Y., New York**—The Lehfri Realty & Constr. Co., Inc., c/o J. M. Berlinger Engr. and Archt., 469 7th Ave., will build a 4 story garage at 308 East 48th St. Estimated cost $200,000.

**O., Canton**—The Gilliam Mfg. Co., 820 Savannah Ave., N. E., manufacturer of taper roller bearings, castings and harness saddles, plans to build an addition to its plant. B. T. Steiner, Pres.

**O., Cleveland**—J. Bassichis & Son, 309 Society for Savings Bldg., are having plans prepared for the construction of a 2 story, 25 x 92 ft. addition to garage at 1532 Lakeside Ave. Estimated cost $40,000. A. Sharowsky, 2045 Marlowe Ave., Archt.

**O., Cleveland**—The Eagle Improvement Co., c/o H. D. Hughes, Archt., 920 Citizens Bldg., is having plans prepared for the construction of a 2 story, 100 x 115 ft. garage on Eagle Ave. Estimated cost $100,000.

**Okla., Oklahoma City** — J. B. Rolater, Shops Bldg., will build a 2 story, 100 x 140 ft. garage at 913-919 North Bway. Estimated cost $40,000.

**R. I., Providence**—The Bay State Realty Co., c/o A. J. Frappier, Archt., 86 Strand Bldg., is having plans prepared for the construction of a 3 story, 94 x 150 ft. garage and service station. Estimated cost $150,000.

**S. D. Watertown**—The Holt Motor Co., 226 East Kemp Ave., is having plans prepared for the construction of a 1 story, 57 x 100 ft. garage. Estimated cost $90,000.

**Tex., Athens**—The Tri County Motor Co. plans to build a 1 story, 50 x 115 ft. garage on Market St. Estimated cost $45,000. Engineer or architect not announced.

**Va., Roanoke**—The Norfolk & Western R. R. awarded the contract for the construction of a 1 story machine shop at East Roanoke works. Estimated cost $65,000.

**Wis., Cornell**—A Fox will build a 1 story, 100 x 132 ft. garage. Estimated cost $50,000.

**Wis., Hartland**—The Hornberg Motor Co. is having plans prepared for the construction of 1 story, 60 x 70 ft. and 30 x 50 ft. additions to garage. Estimated cost $40,000. Eschweiler & Eschweiler, 210 Mason St., Milwaukee, Archts.

**Wis., Milwaukee**—H. E. Weber, Inc., 583 Jefferson St., is having revised plans prepared for the construction of a 1 story, 122 x 130 ft. service station on Martin St. Estimated cost $150,000. Van Ryn & De Gelleke, 114 Grand Ave., Archts.

**Wis., West Allis**—The Rosenthal Corn Husker Co., 7424 Elm St., will build a 1 story, 60 x 70 ft. and 55 x 57 ft. foundry on Greenfield St. Estimated cost $40,000.

**Que., Montreal**—The McKinnon Steel Co., Ltd., Sherbrooke, plans to build a plant for the fabrication of structural steel on Hamilton and St. Patrick Sts., here. Estimated cost $250,000.